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**A FOOD SECURITY APPROACH TO MARINE PROTECTED  
AREA IMPACTS ON SURROUNDING FISHING  
COMMUNITIES: THE CASE OF KISITE MARINE NATIONAL  
PARK IN KENYA.**

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**Thesis submitted for the Degree of Doctor of Philosophy  
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## **Declaration**

This thesis is the result of original research undertaken by myself, unless stated otherwise in the text, under the supervision of Prof. J.M. McGlade, Dr. E.J. Milner-Gulland and Dr. C. Sheppard.

All sources of information have been specifically acknowledged. No part of this work has been submitted for a degree in any other University.

Delphine Malleret-King, May 2000

## Summary

Marine Protected Areas (MPAs) have been suggested as one of the solutions to coral reef fisheries management. It is thought that their effects on biomass, species diversity and habitat could improve surrounding fisheries yields through fish migration and increased recruitment. However, MPAs' benefits on surrounding fisheries are difficult to establish due to the lack of historical data. Furthermore, the lack of involvement of stakeholders have led to a number of failures. MPAs in the form of No Take Zones (NTZ), which aim to promote the sustainable use of fisheries resources, might contribute to the successful management of coral reef fisheries. However, few studies have considered their benefits from the point of view of surrounding fishing communities. It is evident that if stakeholders are to be further involved in MPA management, they need to perceive the benefits.

The hypothesis tested was that if NTZs are of benefit to surrounding communities, their food security situation would be improved. The fieldwork was carried out in Southern Kenya with five fishing communities located around a long established MPA. The study showed that a range of food security indicators gave good information on MPAs' benefits to the surrounding communities. It was found that these benefits were highly affected by distances. Thus, although fishing households were the least food secure, they were better off if they fished nearer the protected reefs. Households dependent on MPA-related tourism were the most food secure but this dependency decreased with the communities' distance from the main tour operators. The results showed that MPAs' benefits were not equally shared by the communities bearing most of the costs.

In addition, it was also found that tourism seasonality does not always compensate for the seasonality of other activities. Furthermore, tourism could not be assumed to develop around MPAs and provide reliable alternative employment.



***PhD Title : A food security approach to Marine Protected Area impacts on surrounding fishing communities: the case of Kisite Marine National Park in Kenya.***

## **Introduction**

The available global food supply is enough to provide at least 2700 calories per person per day but it is estimated that 800 million people are still suffering from hunger (Ricupero, 1999). In order to understand poverty and causes of hunger, the concept of food security has had to move away from its first definition: “*Availability at all times of adequate world supplies of basic food stuffs...*” (UN, 1975) based on an analysis of the world food situation through global food balance sheets. Famine crises in Africa whilst food balance sheets were positive, have led to the realisation that the roots of poverty and food insecurity lie in the conditions of access to food rather than in its availability (Sen, 1981, Swift, 1989). This is reflected by the fact that although global food production is more than keeping pace with population growth, the number of poor and food insecure has not declined (Maxwell, 1997).

Food policies now put more emphasis on access to food resources. At the same time, they have shifted from a world-wide view of food security to a regional, national, local and even household level (Maxwell and Frankenberger, 1992). The need for a disaggregation of food security analysis was made clear by the realisation that the food situation varied enormously within regions and nations. Thus, using national, regional and world averaged figures did not reflect the situation within most developing countries and did not help in identifying pockets of poverty or in tackling hunger. Instead, achieving household food security, defined as “*...all people at all times have physical and economic access to adequate, safe and nutritious food for all household members, without undue risk of losing such access*” (FAO, 1996a), has



become a priority for international agencies. Household and local approaches to food security have become paramount in recent years and more so as overexploitation of renewable natural resources have become of concern. At a local level, a decline in natural resources threatens human communities who depend on them for their livelihoods and food security (Maxwell, 1997).

The unsustainable use of natural resources has particularly touched fisheries. 70% of the exploited fish stocks are considered to be depleted, overexploited or unsustainably used (FAO, 1995). Coral reef fisheries have not escaped this fate where cases of collapsing fisheries are particularly prevalent (e.g. in the Pacific, in the Indian Ocean particularly in Kenya and Tanzania) (White *et al.*, 1994, FAO, 1995). Coral reef fisheries are nearly all located in developing countries and so their decline contributes to further marginalising coastal fishing communities with few alternative livelihood opportunities (Russ, 1991). One of the factors responsible for fisheries decline is believed to be the way their management has been approached during the last fifty years. It is thought that fisheries management traditionally based on open access to resources, unreliable information and on simple single species models has led fisheries managers to take misinformed and high risk decisions thereby leading to fisheries overexploitation (Larkin, 1977, Troadec, 1989, Ludwig *et al.*, 1993, Pauly, 1994, Lovejoy, 1996, Larkin, 1996, Roberts, 1997, Lauck *et al.*, 1998).

For decades, sustainable use and protection of terrestrial biodiversity strategies have taken the form of Protected Areas (PA) (Dixon and Sherman, 1990). However, the application of the PA principle to the marine environment has been relatively recent and it is only since 1982 that Marine Protected Areas (MPAs) have been recognised as having an essential role in the conservation of marine resources. They are defined as: *“Any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment”* (19th IUCN General Assembly, 1994 Res.19.38).

Six types of MPAs are currently defined according to their use for strict protection, ecosystem conservation and recreation, conservation for natural features, conservation through active management, conservation and recreation of landscape/seascape and sustainable use of the natural ecosystem (Gubbay, 1995). However, 'Marine Parks', 'Marine Reserves', 'Marine Sanctuaries', 'Special Areas', 'Closed Areas' are often used as substitutes for each other even though they have very different objectives (Pullen, 1996). To these, No Take Zones (NTZ) have been added. NTZ is defined by WWF (1998) as: "*Temporarily or permanently closed area to consumption uses*". Their purpose has also been clarified and is to promote the sustainable use of natural resources by safeguarding species, their habitat and their ecosystems (WWF, 1998, Clarke, 1999).

In 1999, there were 1300 MPAs in 18 regions (Clarke, 1999) over the developing and the developed world (e.g. in the UK, France, the Philippines, the Caribbean islands, Kenya). The first NTZ was established in New Zealand in 1977 and was followed by the creation of 12 other zones mainly where commercial fisheries dominate (Clarke, 1999, Horwood, 2000).

It is important not to confuse NTZs with MPAs. In this research, 'MPA' is used as a generic term referring to all defined areas which protect marine resources in any way and for any purposes and the term 'NTZ' refers to MPAs which role would be to achieve sustainable fisheries management by forbidding all extractive uses permanently.

As 'classical' fisheries management models and tools have failed, the role of MPAs for conservation and the sustainable use of marine resource has been emphasised more and more (e.g. in the 'Agenda 21' of the UNCED (Chap.17)). The effects of established Marine Protected Areas (MPAs), within which resource use is controlled and reduced, on the biomass, density and species richness of reef fishes have led to the belief that they could be effective as fisheries management tools and particularly



well-suited to the complexity found in coral reef fisheries (Roberts and Polunin, 1991, Roberts, 1997).

There is however little evidence as yet of MPAs' contribution to replenishment of surrounding fisheries (Munro, 1996). Nevertheless, despite the uncertainties attached to the effectiveness of MPAs (e.g. design and location) for coral reef fisheries management (Carr and Reed, 1993), their use is increasingly advocated as they are considered as one of the only available precautionary approaches to fisheries management (Lauck *et al.*, 1998). The idea underlying the precautionary principle being that uncertainties about the effects of human activities on the ecosystem are grounds to stop or control these activities rather than continuing them (Douma, 1998, Thomson, 1998).

Conditions identified for MPAs to be successful in the replenishment of surrounding fisheries are their permanent closure to extractive activities combined with strong enforcement (Allison *et al.*, 1998, Lauck *et al.*, 1998). Lessons learnt from past failures have shown that long term implementation and effective enforcement of MPAs are highly dependent on support from the resource users themselves (White *et al.*, 1994). So, as with food security, it is more widely agreed that natural resources management must not be detached from the users and should be looked at from a local point of view (White *et al.*, 1994, Leach *et al.*, 1997, Borrini-Feyerabend, 1998, Salm and Ngoile, 1998). Involving local communities in MPAs' management has therefore become the motto of most national and international agencies. But this presupposes a good understanding of their socio-cultural framework, of the constraints and functioning of their production system. It also requires legal and institutional adaptation and most of all, the will of the communities to participate. This is because the establishment of MPAs usually means a reduction of the traditional fishing grounds for the users. Unfortunately, convincing arguments to which communities can relate are often lacking.



In recent years, economists, ecologists, biologists, sociologists, anthropologists and fisheries managers, have agreed that, to achieve household food security and sustainable use of fisheries resources, multidisciplinary approaches are needed (Larkin, 1996). However, I argue that, when examined, the performances of established MPAs have, in reality, been looked at in a segmented way and predominantly from a biological perspective. This segmentation has not allowed a holistic understanding of the impacts of MPAs on marine resource users to emerge, particularly in the case of coastal communities in developing countries. I suggest that the concept of household food security will help us to understand if and how MPAs affect surrounding fishing communities.

## **Objectives and outline of the Research**

The hypothesis that I test is that by enabling better management of coral reef fisheries, no take zones (NTZ), which are a type of MPA within which all extractive activities are forbidden, should improve the socio-economic situation of surrounding communities. To test this hypothesis, the socio-economic status of five communities surrounding the 20 years old Kisite Marine National Park (Southern Kenya) is studied and compared.

Kenya is the first developing country to have protected its marine resources and thus has been at the forefront of marine habitat protection. MPAs were established in Kenya as far back as 1968. Small-scale coral reef fisheries and dense tourism development are characteristic of the Kenyan coastline and similar to other tropical developing countries located in coral reef areas. Furthermore, the decline of coral fisheries resources and the conflicting uses of coastal resources reflect the problems faced by other coral reef fisheries around the world.

The importance of stakeholders' participation for successful NTZ management has been recognised. However, to participate, stakeholders need to be convinced of the benefits of NTZs to themselves. Arguments, that communities can relate to need to



be put forward. The aim of this research is to look at the benefits of the presence of an MPA from the point of view of the stakeholders. Three main sets of questions underlined the research:

1. How do stakeholders perceive the MPA, its management, its benefits and drawbacks? The way stakeholders relate to management authorities and the way they perceive the established MPA can be crucial to the MPA's enforcement.
2. How has the MPA affected the surrounding fishing communities, from their own point of view? To investigate the socio-economic status of communities, food security cumulative indices were developed (e.g. the one pioneered by Maxwell (1996)).
3. How does tourism relate to the MPA - is it a result of the presence of the MPA? Does MPA-related tourism create positive effect for surrounding communities?

In the first chapter the concept of food security is briefly presented and links between this concept and coral reef fisheries are examined. The status of coral reef associated fisheries and the reasons for their degradation are also discussed in chapter one. In chapter 2 issues related to MPAs such as their use, their benefits, their costs and their management are reviewed. At the same time, the lack of defined monitoring procedures for MPAs is examined.

Chapter 3 introduces the study site in its historical, geographical and ecological context. Information for the study was collected mainly through participatory methods which are described in chapter 4 along with the concepts on which is based this study (e.g. units of studies).

Chapter 5 aims to answer the first set of questions and look at the way MPAs are perceived by stakeholders. Do stakeholders perceive any benefits of the 20 year old

MPA, do they perceive any benefits in terms of the improvement of fishing yields. Different stakeholders are studied and their opinions are analysed.

Chapter 6, 7 and 8 focus on the second set of questions. Chapter 6 explains how the food security indices used to look at the performance of the MPA in quantitative terms are set up in the context of the study sites. The theoretical framework of these indices is described in that same chapter. In chapter 7, the results of households surveys are shown and potential links with the presence of the MPA are discussed. The case of the households depending on fishing is investigated further in chapter 8.

Finally, chapter 9 concentrates on the third set of questions and examines the importance, the advantages and drawbacks of the tourism sector for the studied sites.

In each chapter there is a discussion on the methods and outcomes. The conclusion contains a summary of the overall findings of this study, puts them into perspective, emphasises the lessons learnt and provides suggestions for further work.



# **1 Household food security threatened by current coral reef fisheries management**

## **1.1 HOUSEHOLD FOOD SECURITY AND CORAL REEF FISHERIES**

Food insecurity is a world-wide concern. The first part of this chapter introduces the concept of food security in its broader context, and identifies links between coral reef fisheries and food security. The second part examines the status of coral reefs and associated fisheries. This review emphasises how the declines in coral reef fisheries, partly caused by maladapted management strategies, threaten coastal people's food security.

### **1.1.1 Food security on the world stage**

#### **1.1.1.1 Half a century of international concern**

International concerns about hunger in the world were expressed at the birth of the Food and Agricultural Organisation (FAO) in 1945. The FAO was created with the aim of eradicating hunger from the planet. At the same time, in Bretton Woods, the will for a new world order based on free trade was formalised and led to the creation of two institutions; the International Monetary Fund (IMF) and the World Bank (WB) (Lehman, 1996, Maxwell and Frankenberger, 1992).

With the creation of the FAO, the right to food was recognised as a human right and became part of the Declaration of Human Rights of 1948 (Maxwell and



Frankenberger, 1992). The FAO's proposal to guarantee this right to food was to reduce price fluctuations of agricultural products in order to introduce stability on the food commodities market. However, whereas the FAO believed in government intervention to ensure basic living standards and to build diversified, farming oriented economies (Kirshner, 1996), the Bretton Woods institutions were promoting free trade so as to achieve an optimal distribution of resources world-wide.

The Uruguay Round of the GATT and the resulting increased globalisation of markets have shown which way the scale has tipped between free trade and interventionist strategies (Lehman, 1996, SOLAGRAL, 1996, Ricupero, 1999). As the world opted for free trade, the FAO's proposals were never implemented (Lehman, 1996). The belief was that by removing market distortions (i.e. by government intervention), market forces would be able to function freely and resources would be optimally allocated. In turn, optimal economic resource allocation would eventually lead to the eradication of hunger in the world.

Unfortunately, the crises of the 1970s, 80s and 90s, particularly in Africa, proved this theory wrong. Increased liberalisation has not brought food security and market forces have not reduced poverty (Maxwell and Frankenberger, 1992, Lehman, 1996, Ricupero, 1999). The results of the free trade approaches were brought to light at the Third FAO World Food Summit (WFS) of 1996.

#### **1.1.1.2 World Food security**

In preparation for the WFS, the FAO, World Bank, IFPRI (International Food Policy Research Institute) and OECD (Organisation for Economic Cooperation and Development) made projections of the world food situation (food supply, demand, world prices and trade) up to the years 2010-2020. These studies, based on past and present trends, showed that the world agricultural growth rate had decreased from around 3% per year during the 1960s to 2% between 1980 and 1992 (Alexandratos, 1995, Mitchell and Ingco, 1995). Projections indicated that this decreasing trend

would continue (e.g. the FAO projected the annual agricultural growth rate to be 1.8% from 1988-90 to 2010). The growth rate in 1996 was 1.8% (FAO, 1996b).

Although discussions arose about the adequacy of the assumptions used by the different institutions for modelling future trends, there was a general consensus on the fact that the global food supply would continue to outpace the estimated world population annual growth rate of 1.5% (Maxwell, 1997). The global supply of grain per head was 250 kg/year in the 1950s, increased to 380 kg/year in the 1980s, and dropped to 350 kg/year during the 1990s but the average person needs 220 kg of grain per year (Maxwell, 1997). At aggregated levels Malthusian theories were rejected once again.

However, even though the world food supply is sufficient to feed everyone (Ricupero, 1999), there are still 800 million people in the developing countries who are chronically undernourished (FAO/WHO, 1992). Sub-Saharan Africa (SSA) and South Asia are the most affected with half of the SSA population suffering temporary food shortage (Mitchell and Ingco, 1993). Furthermore, projections indicated that 20% of the SSA population will suffer from hunger in 2000 (Mitchell and Ingco, 1993).

The food situation differs between the South and the North but it varies also within sub-regions and within nations. Thus, the food situation cannot be assessed from an aggregated point of view; disaggregated levels must also be considered. At the WFS, it was recognised that the debate should not be concentrating on whether there was enough food in the world anymore, but whether on a disaggregated level (local, household) people have access to enough and adequate food. The shift in the debate reflects an improving understanding of what constitutes food security.

### 1.1.1.3 Growing understanding of what constitutes food security

Recognised as an international issue in the Declaration of Human Rights of 1948 (art. 25)<sup>1</sup>, the concept of food security was only formalised in 1975 (Maxwell and Frankenberger, 1992). It was defined as “*Availability at all times of adequate world supplies of basic food stuffs...and sustain a steady expansion of food consumption...and offset fluctuations in production and prices*” (UN, 1975).

However, the definition of food security as the balance between food supply and demand from a global point of view was soon revealed to be inadequate. The severe African crisis of the mid 1980s happened whilst world supplies were enough to satisfy world food demand (Maxwell and Frankenberger, 1992). Thus, the definition of food security changed; from taking into consideration only the macro level it was made to encompass the micro level. The concept of access to food was introduced and the definition changed to: “*Ensuring that all people at all times have both physical and economic access to the basic food they need*” (FAO, 1983). This definition finally became: “*that state of affairs where all people at all times have physical and economic access to adequate, safe and nutritious food for all household members, without undue risk of losing such access*”. (FAO, 1996a). This last definition is the one used for the purpose of this research.

Whereas in early definitions, enough food was merely understood as calories/year/person (for survival) the meaning was widened in the most recent definition to adequate, nutritious food. Quality as well as quantity of food are now regarded as essential, not only to survive but also to lead a productive life.

The theory of access to food was formalised by Sen (1981), through the concept of food entitlements. According to Sen (1981), households have access to food through

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<sup>1</sup> In the part relating to economic, social and cultural rights, article 25 concerns the rights to an adequate standard of living which includes: *food, clothing, housing, and medical care and necessary social services, and the right to security in the event of unemployment, sickness disability, widowhood, old age or other lack of livelihood...*



different channels (capacity to produce, assets, what they can trade or exchange) which constitute entitlements. Swift (1989) extended the entitlement theory to integrate community support, claims, stores and investments (Maxwell and Frankenberger, 1992). The concept of entitlements shows how people have access to food and allows the emergence of a new way to assess food security at micro levels. For Maxwell (1997) local and household food security have become the main concern because food security is a matter of access to food and the key to access to food is livelihoods.

Furthermore, it was recognised that to understand the capacity of households to resist shocks (e.g. climatic, economic, political) it was essential to have knowledge about past shocks and past household strategies. The ability of households to stay food secure through a shock is function of their vulnerability (Swift, 1989), itself a function of past and present situations. More recently, it was advised that the concept of food security should be integrated in the wider context of livelihood security. Food security is then considered only as part of the process of securing livelihood which is thought to be the households ultimate aim (Davies, 1993).

The importance of coral reef fisheries and the threat their decline represents for coastal communities can be best understood if examined from a local/household level and in the wider context of livelihood security.

### **1.1.2 The role of fisheries in terms of food security at the macro and micro levels**

#### **1.1.2.1 The state of fisheries and threat to global food security**

120 million people were estimated to be partly or totally dependent on fisheries in 1990 (FAO, 1995). In Africa alone it was thought that 35 million (5% of the population) depended in one way or another on fisheries. Fisheries are important not only as a source of food but also as a source of income, well being and livelihoods.



The trade in fish has increased continuously since the 1940s and the developing countries' share in this trade increased from 42.5% in 1983 to 49% in 1993. However, due to overfishing, 70% of the stocks assessed are exploited beyond the Maximum Sustainable Yield (MSY) (FAO, 1995). Overcapitalisation of the industrialised and semi-industrialised fleets pushed by subsidies and high prices has led to the overexploitation and economic overfishing in nearly all fisheries (Troade, 1989). Thus, whilst effort and demand have continued to increase since 1990, the supply has stagnated at 70 millions tons (50 million tons of marine captures) of fish for human consumption since 1990 (FAO, 1995). The capacity for exploitation is larger than the resource can cope with and demand is growing faster than supply (the fish supply per capita was 13.6 kg/year in 1989 and was 13.0 kg in 1993 (FAO, 1995)). If past trends continue, at the lower point of supply projections a 50 million tons production deficit is expected by 2010 (FAO, 1995). A shortfall in supply would put pressure on the real price increasing the threat on the food security of the poorest.

Fisheries seem to be a sector in which the overexploitation of limited resources have led to a Malthusian situation. For example, in Africa, the increase of the demand seems to mostly come from the population increase (FAO, 1995).

#### **1.1.2.2 The role of coral reef fisheries in food security at the micro level**

Fisheries collapse threaten the food security of people who depend on them, especially at the local level. Although coral reef fisheries do not seem important at the national level (e.g. in terms of catch and revenue), they may represent the only source of livelihood for local communities (Russ, 1991). Through protein supply and as a source of income, coral reef fisheries are the food security basis for millions of people. Examples in Kenya or the South Pacific illustrate this point; 70% of a Kenyan coastal fishing community depends on the coral reef fishery for 80% of its income (Malleret-King, 1996), 90% of the protein supply for some South Pacific



islands come from coral reef fisheries (WWF, 1992) and in the Philippines the most productive reefs provide 70% of the total fish catch for food (White *et al.*, 1994).

Coral reef fisheries are predominantly located in developing countries, and in areas where few employment opportunities exist (Russ, 1991, White *et al.*, 1994). One of their characteristics is that they are exploited mostly for direct human consumption in contrast to deeper or more offshore fisheries<sup>2</sup> (White *et al.*, 1994). They also represent a last resort for people to subsist when other possibilities have failed (e.g. unemployment due to the collapse of other industries) (Valdes-Pizzini, 1995, Munro, 1996). Coral reef fisheries location and their characteristics lead to situations where coastal communities are particularly dependent on the fishery for food and livelihood (see also section 2.1).

If Malthusian theories are not upheld on a global level (section 1.1.1.2) they might be verified in local situations, particularly in artisanal fisheries such as coral reef fisheries. Due to population growth a larger increase in resource demand than in supply can occur when people solely depend on natural resources with no adapted technology permitting them to by-pass environmental conditions (e.g. low potential areas where the green revolution paradigm was not adapted); when overcapitalisation leads to resources limits being exceeded; or when management regimes are not adapted to the characteristics of resource exploitation.

As the population grows and/or socio-economic conditions change (e.g. space restriction, economic priorities), increasing pressure is put on natural resources, which can become severely depleted (Pauly, 1994). This situation, defined as Malthusian fishing, happens in some coral reef fisheries, thus threatening coastal communities' food security. It has been estimated that damages to reefs in the Philippines may have resulted in the loss of work for 127 000 fishermen and could

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<sup>2</sup> Offshore fisheries are also exploited to produce fish meal and fish oils. These represented 35.9% of the marine captures in 1990 (based on FAO, 1995).



cause malnutrition as coral reefs account for 50% protein supply of the Philippines (McAllister, 1988).

### **1.1.3 Conclusions**

Food security is not a matter of global food supply and demand levels anymore. Access to food supply at micro levels has been recognised as the key component for achieving food security. This is essential when trying to understand the role of fisheries in providing food security. Fisheries act as a source of food and income and as livelihoods but they are acknowledging a world scale crisis. The threat of fisheries resources depletion represents in terms of food security in developing countries is acute, particularly in the case of coral reef fisheries.

## **1.2 CORAL REEFS STATUS AND THE RESULTS OF FISHERIES MANAGEMENT**

Coral reef fisheries can be essential for coastal communities to achieve food security. This section shows how past management practices have not prevented coral reef and related fisheries degradation thereby threatening the food security and livelihoods of thousands of coastal communities in the developing world.

### **1.2.1 Coral reef degradation: a threat to local food security**

#### **1.2.1.1 Coral reefs importance in terms of tourism and fisheries**

Coral reefs are found in 110 countries in the tropics, mostly developing countries. They are the most diverse marine ecosystem providing substrata for sedentary organisms and habitat and shelter for a high diversity of species (e.g. 3000 different



species can be found on a single reef in the region between Northern Australia, Indonesia and the Philippines, WWF, 1992). Surrounded by warm tropical low productivity waters, coral reefs are one of the most productive marine ecosystems with primary productivity ranging from 1500 to 12000 gCm<sup>-2</sup>, twice as much as the surrounding waters (Barnes and Hughes, 1991). Furthermore, not only do they support important fisheries at a local level but due to their diversity and aesthetic value, coral reefs also represent an attraction for tourism development (e.g. Caribbean, the Indian Ocean, the Pacific islands and the Red Sea are experiencing reef-related tourism boom, IUCN, 1993). However, increased pressure on coral reef ecosystems has led to their degradation.

#### **1.2.1.2 Status of coral reefs**

Of the 5.6 billion people living on earth in 1991, 3.5 billion people lived in the coastal areas with dense clusters in coral reef areas (White *et al.*, 1994). Coral reefs protect the coast from wave action, from erosion, they provide natural breakwaters for harbours, they are a source of recreation and they support artisanal fisheries. Unfortunately, they are very fragile ecosystems and their degradation is highly correlated to the population densities on coastal areas (IUCN, 1993). Construction, land clearance and agricultural expansion accompany population growth and lead to land erosion which, in turn, results in increased siltation and sedimentation levels degrading coral reefs (Kuhlman, 1988, Roberts, 1993). At the same time, higher domestic waste and fertiliser use accentuate pollution levels which can cause eutrophication adding to reef damage (Kuhlman, 1988; Wells and Sheppard, 1988, Roberts, 1993). The above trends combine with an increase in reef organism extraction for trade and subsistence and the use of destructive fishing methods. These methods are often linked to poverty (e.g. dynamite, cyanide poisoning) menacing further coral reefs and related resources (Wells and Sheppard, 1988, Kuhlman, 1988, IUCN, 1993, McManus, 1997).

Tourism development which is mostly directed towards coastal areas (Weber, 1994, Price *et al.*, 1998), has added to the already existing pressure on coral reef



ecosystems. Tourism, rarely cautiously managed, is one of the most lucrative industries (Price *et al.*, 1998). It creates employment in host countries and can represent high proportion of their GDP (e.g. in the Caribbean 15 to 30%) (Dixon *et al.*, 1993). However, it also represents a threat to the marine environment by accentuating population pressure, increasing coastal development and sewage, but also through the intensive development of marine based activities such as diving and snorkelling (Beeckhuis, 1981, Ormond, 1982, Hawkins and Roberts, 1992, 1993, 1994, Price and Firaq, 1996). Moreover, tourism accentuates the pressure on local resources by acting as an outlet for local market (Spurgeon, 1992).

In coastal ecosystems, terrestrial and marine activities interact and impact on each other which accentuates management difficulties. The increased attraction and use of coral reefs in the last 40 years have led to serious degradation. It is thought that 10% of reefs have been degraded beyond recovery, 30% are likely to be lost in the next 10-20 years and another 30% in the next 20 to 40 years (Wilkinson, 1992). 40 to 50% of all Caribbean reefs are degraded and do not seem to be recovering (Talbot, 1997) and South/Southeast Asian and Indian Ocean reefs are considered the most at risk (Jameson *et al.*, 1995) with 20% of the Indian Ocean reefs already destroyed in 1985 (IUCN/UNEP, 1985).

The damage and overexploitation of reefs have threatened the livelihood and food security of millions of people depending on these resources (Salvat, 1987). Although artisanal fishing is the subject of this research, it is important to realise that coral reef fisheries do not operate in isolation, land based activities and marine based activities highly affect them (e.g. by affecting the fish habitat).

### **1.2.2 Classical fisheries management and coral reef fisheries**

Small-scale fishing is the most important use of coral reefs (Russ, 1991). Coral reef fisheries represent 10-12% of the world's catch (Rajasurya, 1996) and contribute for



20-25 % to the catch of developing countries (Jameson *et al.*, 1995). In the South Pacific, people derive up to 98% of their animal protein intake from coral reefs (Wilkinson and Buddemeier, 1994). The yearly potential yield of coral reefs is believed to be 6 million metric tons (Smith, 1978) but is thought to be underestimated (Munro, 1996). Unfortunately, coral reef fisheries management has had limited results and these are generally overexploited (Munro, 1996). Reasons for this situation are numerous, they lie often in the economic and social conditions but most of all in the principle on which conventional fisheries management is based.

#### **1.2.2.1 Overfishing in coral reef areas**

Impacts of fishing on coral reef ecosystems have been widely studied (McClanahan, 1994, Polunin and Roberts, 1996, Sale, 1991, Russ and Alcala, 1996a, McManus, 1997). Effects can be divided into two types, the direct effects on the fish population (i.e. reduction of individual mean size, of biomass) and the indirect effects (i.e. on the fish habitats) (Russ, 1991). Six levels of overexploitation have been identified, growth, recruitment, biological, ecosystem, economic and Malthusian overfishing (Russ, 1991, Dugan and Davis, 1993, Polunin and Roberts, 1996, McManus, 1997).

Growth overfishing happens when fish are caught before they can grow (Pauly, 1994), and its sign is a shift in the size structure of the larger species (Russ, 1991, Jennings and Lock, 1996). It has been observed in numerous locations from the Caribbean to South East Asia (Bohnsack, 1982, Wyatt, 1982, Munro, 1983, Koslow *et al.*, 1988, Russ, 1991, Pauly, 1994, Russ and Alcala, 1996a, McManus, 1997). Other types of overfishing might not be as easily detected. Recruitment overfishing which occurs when so few adults are left in the fished stock that egg production and subsequent recruitment are hindered (Pauly 1994), lowering future yields. This situation may be strongly linked to growth overfishing, as an exponential relationship is thought to exist between the size of fish individuals and number of eggs produced (Roberts, 1997). Biological overfishing is a combination of recruitment and growth overfishing (McManus, 1997).

Ecosystem overfishing is the result of a change in community composition, of relative abundance of species (Russ, 1991, Pauly and Chua, 1988, Pauly, 1994). This often happens as large, slow growing top predators (e.g. groupers) are often preferred targets in coral reef fishing (Russ and Alcala, 1996a, 1996b, McManus, 1997). Species interact with each other through competition, predation and mutualism and the level of these interactions is crucial to understanding the effects of fishing on coral reefs (Munro and Williams, 1985). The removal of key species can destabilise the community structure, trophic relationships (Hughes, 1994, Nolan, 1998) and even lead to increased bioerosion (McClanahan and Muthiga, 1988, Roberts and Polunin, 1991). For example the effects of fishing on the reef ecosystem have been widely studied in Kenya. The high number of sea urchins which have been attributed to the reduction of their predators and competitors through fishing have led to an increase of erosion through grazing (McClanahan and Shafir 1990, McClanahan, 1994).

When fishing effort exceeds the effort required to achieve the maximum economic yield (Russ, 1991) economic overfishing happens and when the effort exceeds the coping capacity of the resource, Malthusian overfishing occurs. Both situations are more and more widespread (Dugan and Davis, 1993). Malthusian overfishing (Pauly, 1988, Pauly *et al.*, 1989) has been observed in numerous tropical locations such as in the Philippines and Thailand (Pauly, 1994). It often occurs in situations where fishing is the last resort and it is part of a vicious circle. Overexploited, the resources decline, fishers then increase the effort in order to maintain their income thus putting more pressure on the resource which gets further depleted.

Overexploitation also concerns other reef organisms such as crustaceans, cephalopods, holothurians or gastropods. Some populations have been totally wiped out in some areas (e.g. lobsters, sea-cucumbers in parts of Kenya, shells) (Wells and Sheppard, 1988, Glaesel, 1997).



Overfishing and destructive fishing methods are often linked to poverty and high unemployment (McManus, 1997). Coral reef fisheries are easy to enter and represent the last resort for a lot of poor households (McManus, 1997, Russ, 1991). Thus, the combination of local economic, political, demographic situations and added international pressures (i.e. tourism) has meant that numerous coral reef fisheries now show signs of overexploitation (Munro, 1996).

#### **1.2.2.2 Coral reef fisheries management**

Coral reef fisheries can be crucial to food security at local and household levels (a source of food, the only source of income and the last resort for unemployed people). Their importance however, does not come so much by the revenue they provide but by the last resort of livelihoods and employment they represent (Russ, 1991). They are often viewed by management agencies as not important enough economically to warrant spending money on detailed research (Russ and Alcala, 1996a). However, the cost of malnutrition and unemployment can be very high at the national level (Spurgeon, 1992) when the fishery is ignored, not managed efficiently, or its importance is underestimated.

The success of natural resource management, and particularly fisheries, management has been questioned for decades (Larkin, 1977) but approaches have not changed (Ludwig *et al.*, 1993, Lovejoy, 1996, Roberts, 1997, Lauck *et al.*, 1998). The sustainable management of most natural resources is based on simple single species models such as the Maximum Sustainable Yield (MSY). The MSY represents the maximum level of population which can in theory be taken indefinitely without driving a population to extinction (Milner-Gulland and Mace, 1998). One of the key questions underlying fisheries management has been whether fish stocks are more affected by the harvesting or by the physical environment (Larkin, 1996). By using the simple single species models, fisheries biologists have concentrated on assessing commercial fish stocks and evaluating their response to harvesting (Troadek, 1989, Larkin, 1996). Management tools resulting from this approach have mostly targeted the catch (i.e. quotas, gear restrictions, mesh size) and the effort (limitation of

numbers of fishermen or vessels, closed seasons or temporary closed areas) (Berkes, 1985, Troadec, 1989, Roberts and Polunin, 1991, Carr and Reed, 1993, Larkin, 1996, Holland and Brazee, 1996, Roberts, 1997).

Current and past management practices have not led to the sustainable use of fisheries resources (FAO, 1995) and have been particularly maladapted to the complexity of coral reef fisheries (Russ, 1991, Roberts, 1997). The weaknesses of the models, failures to take account of uncertainties (Pauly, 1994, Roberts, 1997, Lauck *et al.*, 1998, Allison *et al.*, 1998, Larkin, 1996) and intrinsic characteristics of marine resources (Troadec, 1989) are thought to be the main causes for the collapse of fisheries world-wide.

For example, simple single species models (i.e. the MSY) are based on the assumption that an equilibrium exists between effort level and stock abundance, however it is thought that fish stocks are more influenced by environmental conditions than by harvesting (Carr and Reed, 1993, Larkin, 1996, Roberts, 1997). Moreover, the models do not take account of the dynamic relation between recruitment and stock size (Holland and Brazee, 1996, Roberts, 1997). Research has suggested that an exponential relationship exist also between individual fish weight and egg production (Carr and Reed, 1993, Dalzell, 1996, Roberts, 1997).

In addition, these models are single species and single gear fisheries models which is considered unrealistic and has led managers to treat species as if in isolation. In reality no fishery deals with one species only and no gear is totally selective (Pauly, 1994, Roberts, 1997). This is of most importance in the case of coral reef fisheries which are multispecies and multigear (Russ, 1991, Pauly, 1994, Munro, 1996, Roberts, 1997). Species interactions are crucial to the understanding of the coral reef ecosystem (Russ, 1991).

In response to these weaknesses, multispecies models of coral reefs such as ECOPATH (Polovina, 1984, Christensen and Pauly, 1992) and concepts such as the



Optimal Yield (Lovejoy, 1996) have been developed. These however, have not yet provided good day to day management tools as they depend on an enormous amount of information (Larkin, 1996).

All models depend on large amounts of information. However, statistical data is often unavailable or unreliable (Larkin, 1996, Roberts, 1997). Furthermore, it is argued that current science would not be capable of collecting enough information to parameterise multispecies models, nor would it be possible to fully understand the complex interactions between species and between species and their environment in marine ecosystems (Lauck *et al.*, 1998).

The failure of fisheries management is also linked to an economic, social and political environment. For example, the fisheries world-wide have been considered as being faced by a situation of 'tragedy of the commons' (Troadek, 1989). However, the conditions leading to a situation of 'tragedy of the commons' were rarely met in traditional fishing communities and, in these communities, the 'tragedy of the commons' has occurred parallelly to changes in the social, economic, technical and political contexts (Berkes, 1985). Thus, for Berkes (1985), overfishing is the result of a loss of control over resources through the centralisation of decision making, the change to market economy, the rapid population growth and the technology changes. These intertwined factors have caused the emergence of open access. Although open access has been reduced at an international level by the widespread EEZ claims (UNCLOS, 1982), it is still the dominant regime at national levels (Troadek, 1989).

Fisheries management relies on stock assessment to estimate the yield and catch allowed to achieve sustainable use. However, the cost of information collection is prohibitive thus information is often unreliable or simply does not exist, particularly in developing countries (Johannes, 1981, Russ, 1991, Larkin, 1996). Furthermore, the management regimes are complicated and expensive to enforce (Johannes, 1981). Cost of information, of implementation, bias and lack of political will can be at the root of a lack of enforcement (Milner-Gulland and Mace, 1998). Thus, in most cases

the MSY is overshoot but managers prefer the *status quo* to drastic policies until fisheries are on the point of collapse (Larkin, 1996). Coral reef fisheries are not national priorities in comparison to other sectors of the economy (i.e. tourism); governments' interest has focused more on industrial fisheries development than on the sustainability of small scale artisanal fisheries which bring half as much revenue but represents most of the fishers (Troadec, 1989, Glaesel, 1997). Furthermore, developing countries, where the majority of reefs are located, rarely have the means to implement these kinds of management regimes, or even to simply attempt to manage their fisheries.

Fisheries management methods based on simple single species models were developed for the high seas fisheries and for northern hemisphere type fisheries where species diversity is not high. These models have not had the expected results in the temperate regions for which they had been designed and are usually inadequate for coral reef fisheries.

### **1.2.2.3 Dealing with uncertainties**

Uncertainties are attached to the ecological and biological processes affecting fish stocks, to the lack of data on commercial and non commercial stocks, to economic forces, political will and information collection (Larkin, 1998, Milner-Gulland and Mace, 1998). The main drawbacks of fisheries management models have been their failure to take account of these uncertainties (Pauly, 1994, Roberts, 1997, Lauck *et al.*, 1998, Larkin, 1996, Carr and Reed, 1993). By not integrating measures of uncertainty, deterministic simple single species models have not left any margin of error for fisheries management whilst small changes in the population at constant harvesting levels can lead to rapid population decline (Roberts, 1997, Milner-Gulland and Mace, 1998). For example, if uncertainty was acknowledged, the MSY which represents the maximum harvesting level for sustainable use would represent the upper limit and harvesting would be decided at a lower limit (Roberts, 1997).



Recently, consideration has been given to ways of dealing with uncertainty (Milner-Gulland and Mace, 1998). A solution proposed is to keep using current models but provide managers with decision tools which integrate and openly show risks. This can be done by attaching variance measures to estimated stock assessment and fish mortality rates (Rosenberg and Restrepo, 1994). Another solution is to change the current management approach by making it more flexible and integrated. By being flexible, management strategies can adapt to changing biological and economic parameters (Rosenberg and Restrepo, 1994). Adaptive management is central to the integrated fisheries' management approach (McGlade, 1989) in which the communication between the fishing industry and the management authorities has a key role.

Finally, a much discussed solution is to acknowledge the unmanageable character of uncertainty and not attempt to understand it by using models but use a precautionary approach whereby fish stocks are not entirely opened to harvesting (Lauck *et al.*, 1998). The idea underlying this approach is that scientific '*uncertainty about the precise effects of human activities on the environment constitutes a reason to constrain such activities rather than pursue them*' (Thompson, 1998:1). The precautionary principle was mentioned for the first time in 1987 at the Conference for the Protection of the North Sea, its use for the sustainable exploitation of renewable resources was reasserted in the Rio Declaration of 1992 (Douma, 1998, Thompson, 1998). Although it is not yet a binding principle it is slowly integrated into international and national policies (Douma, 1998).

Marine Protected Areas (MPAs) and No Take Zones (NTZ) are thought to be a way of using the precautionary approach by limiting or forbidding extractive use of resources within a defined area.

### 1.2.3 Conclusions

Although artisanal fisheries are essential for coastal communities in coral reef areas to achieve food security, lack of funds, of political and economic interest, and maladapted management have all contributed to the overexploitation of coral reef fisheries. The unrealistic and inadequate assumptions of the simple single species models have been blamed for the unsustainable way in which fishing resources have been used. At the same time, it has been recognised that irreducible uncertainties are attached to every stages of the fisheries management process. By failing to acknowledge and take uncertainties into consideration, managers have practised high-risk strategies which have resulted in the erosion of people's 'marine resource capital' for which they had taken the responsibility (sometimes people's sole source of livelihood).

The state of fisheries world-wide is preoccupying enough that changing the fisheries management approach has become an emergency. Ways of dealing with uncertainty are being sought and it is believed that NTZ could provide the less risky solution (Lauck *et al.*, 1998), particularly for coral reef fisheries management. The role which MPA and subsequent NTZ could play in coral reef fisheries management is discussed in the next chapter.



## **2 Could No Take Zones be a solution to coral reef fisheries management?**

### **2.1 OBSERVED AND EXPECTED ECOLOGICAL BENEFITS OF MPAS**

The growing understanding of the causes of coral reef fisheries management failure and the observed benefits of established MPA have led researchers to believe that MPA could be used to replenish fisheries. This section investigates the ways in which MPA benefit the surrounding fisheries in coral reef areas.

#### **2.1.1 Late emergence of MPA**

Closing terrestrial areas off to users is not a new concept. Setting aside areas for Royal hunting or for sacred purposes have been used for hundreds of years (Gubbay, 1995). However, the creation of terrestrial Protected Areas (PAs) for public enjoyment, protection of scenic beauty or for recreation emerged with the establishment of the Yellowstone National Park in 1872. The idea that PAs could contribute to the preservation of ecosystems (McNeely, 1982) is very recent. Even though temporarily closed areas to fishing have been used centuries ago (Hinds, 1992), MPAs have been much slower to gain acceptance than PAs. The first gazetted MPA was the Jefferson National Monument in Florida, established in 1935 (Gubbay, 1995). It was only at the second World Congress on National Parks in 1982 that coastal and freshwater ecosystems were made part of the world-wide PAs network. 'Agenda 21' confirmed the need to consider MPA as part wider marine conservation programmes (UNCED, 1992, Gubbay, 1995).



The late development of MPAs on the conservation scene is suspected to have been caused by the characteristics of marine ecosystems. Although it has not been the case at all times, in all societies (Johannes, 1981, Berkes, 1985, Ruddle and Johannes, 1985, 1990), marine resources are now widely considered as common property resources (Christie and White, 1997) and freely accessed, at least at a national level (Troade, 1989). The establishment of MPAs would have challenged user rights (Cocklin *et al.*, 1998). Moreover, the intrinsic characteristics of marine ecosystems (fluid boundaries), the scale of their variability (Allison *et al.*, 1998) and hence the uncertainties attached to them (Carr and Reed, 1993) have also played a role in delaying the use of MPAs. As the degradation of marine resources has become acute, the role of MPAs has increased (Gubbay, 1995, Cocklin *et al.*, 1998). Although they were first established to protect pristine areas for conservation and tourism recreation, they have become major tools in marine conservation policies (Gubbay, 1995).

### **2.1.2 MPAs: a coral reef fisheries management tool**

The benefits of MPAs have been widely studied. The idea of using MPAs for fisheries management emerged from observing their advantages to the habitat and species they protect.

#### **2.1.2.1 Benefits of MPAs for fish population**

The objective of fisheries management is to maintain enough biomass to replenish stocks so as to sustain fisheries (Roberts, 1997). NTZs as a type of MPAs are thought to be able to achieve this aim as, by preventing fishing, they eliminate one of the main causes of fish mortality. Rapid build up of biomass should result from protection as the number of fish and the size of individuals increase (Roberts and Polunin, 1991, Roberts, 1997). From this increase, larger reproductive outputs and improved recruitment inside and outside the NTZ (Dugan and Davis, 1993) could be expected. Preserving an area from all kinds of extracting activities should also help to maintain fish stocks' genetic diversity and habitat diversity (Roberts, 1997).



Furthermore, in terms of management, NTZs are thought to be easier to enforce than traditional tools as it is easier to tell whether a boat is fishing or not than to tell how much it has caught of which species (Bohnsack, 1993).

The combined effects could have positive impacts on fisheries yields in the NTZ's vicinity (Russ, 1991, Roberts and Polunin, 1991, Bohnsack, 1993, Roberts, 1993, Dugan and Davis, 1993, Russ, 1996, Russ and Alcala, 1996a, 1996b, Munro, 1996, Allison *et al.*, 1998). Mechanisms thought to improve the yield of surrounding fisheries are the increase of the spawning biomass leading to an increased recruitment, the increased recruitment and larval dispersion inside and outside the NTZ, the migration of adult fish outside the boundaries of the NTZ as the competition for food and shelter becomes stronger and the indirect effect of the protection of habitat improving juveniles' survival and often leading to better recruitment (Roberts and Polunin, 1991, Russ, 1991, Bohnsack, 1993, Dugan and Davis, 1993, Carr and Reed, 1993, Rakitin and Kramer, 1996, Watson, 1996, Roberts, 1997, Allison *et al.*, 1998).

Studies have shown that an increase in length of some reef fishes is more than followed by an increase in fecundity. For example, Munro (1983) cited in Roberts and Polunin (1991) shows that in the Caribbean, an increase of 25% in length of the Carangidae (*Caranx ruber*) is followed by a 75% increase in fecundity. The differences can be great such as in the case of the serranid (*Epinephelus guttatus*) for which an increase of 17% in length led to a 178% increase of fecundity (Munro, 1983). Increases of the reproductive output per individual and an increase of the number of reproducing individuals could result in an 80% to 660% positive difference of egg production in the protected stocks (Roberts and Polunin, 1991).

Similarly, connections have been detected between recruitment success and the structural complexity of the habitat (Sale *et al.*, 1984, Shulman, 1984, Schroeder, 1987 cited in Roberts and Polunin, 1991). Aggressive methods of fishing are likely to affect this structural complexity. Thus protection of the reefs and limitation of

fishing, particularly aggressive fishing methods (e.g. dynamite) could boost recruitment.

The most commonly observed effects of established MPAs on the fish population they protect include higher density, species richness and higher biomass (Russ, 1985, McClanahan and Shafir, 1990, Russ, 1991, Dugan and Davis, 1993, Polunin and Roberts, 1993, Russ and Alcala, 1996a, 1996b, Jennings *et al.*, 1996, Wantiez *et al.* 1997). For example, in the Philippines, overall fish density was 1.4 times higher inside than outside the MPA (Russ, 1985, Alcala, 1988). Similarly, in Corsica the reef fish abundance and biomass in the rocky areas of a protected area were as much as five times higher than in the near by fished rocky areas (Francour, 1991). In Kenya, it was shown that the densities of finfish were on average 4 times higher inside MPAs (i.e. Watamu and Malindi Marine National Park) than outside (McClanahan and Shafir, 1990).

The increase is particularly significant for the density, biomass and size of mature individuals of large predatory fish which are the most vulnerable species to fishing (Russ, 1985, Rakitin and Kramer, 1996, Russ and Alcala, 1996a). For example, Russ (1985) showed that the average weight of serranids was up to 2 times higher in the protected area of Sumilon Island (Philippines) than in two other harvested control sites. Rakitin and Kramer (1996) found a higher abundance of large predators in a reserve than in the harvested areas in Barbados.

However, due to a lack of baseline data, very few of these studies compare the effects of MPAs on a temporal basis, comparisons are mostly made on a spatial basis (Carr and Reed, 1993, Dugan and Davis, 1993, Russ and Alcala, 1996a, Wantiez *et al.*, 1997). Russ and Alcala (1996a) found however a significant positive correlation between mean density and species richness of large predators and the duration of reserve protection in Apo island (Philippines). Wantiez *et al.* (1997) had the opportunity to look at the changes between the situation prior to the MPA and after five years of protection in New Caledonia. They observed a significant increase of



coral reef species richness densities and biomass (respectively: 65%, 160% and 246%), particularly for the heavily targeted fish species (i.e. groupers).

Mechanisms of replenishment of the surrounding fisheries through improved recruitment, increased recruitment and larval dispersion, improved habitat and juvenile survival and through fish migration are difficult to detect. This is due to the lack of baseline data but also to the cost in time and resources of such exercises (e.g. radio-tracking individuals, marking larvae etc.). Thus, the role of MPAs in terms of recruitment has been directly tested only a very few times (Dugan and Davis, 1993). To test the occurrence of fish migration, Rakitin and Kramer (1996) proposed an indirect measure using the patterns of distribution of fish across the reserve boundaries. No consistent results were found. Furthermore, no higher significant differences were detected between the size and abundance of the sedentary fish and the mobile fish in researched sites which would be expected if the mobile fish emigrated. The heterogeneity of the environment studied and particularly, the discontinuity of the reef, were thought to be one of the explanations for the lack of evidence. Discontinuities could act as barriers to the movement of some species. This problem was also encountered by Watson (1996). Thus, Rakitin and Kramer (1996) could not disprove nor prove fish migration.

Difficulty to detect migrating mechanisms, or the lack of empirical evidence of enhanced recruitment and larval dispersion are not only due to the lack of baseline data and to the practical difficulties but also to the lack of knowledge about numerous parameters affecting these mechanisms. These are some of the elements of uncertainty related to the use of NTZ as management tools discussed in the next section.

#### **2.1.2.2 Uncertainty about the use of MPAs as fisheries management tools**

Studies have shown that MPAs benefit the area they protect but very few have been able to establish proof of their benefits to surrounding coral reef fisheries (Dugan and Davis, 1993, Munro, 1996). The complexity of marine ecosystems and the lack of

available reliable information on fisheries yields prior to MPAs' establishment (Russ, 1991, Larkin, 1996, Munro, 1996, Glaesel, 1997, Wantiez *et al.*, 1997) might be responsible for this lack of evidence.

- ***Rare evidence of benefits to surrounding fisheries***

Evidence of improvement of fisheries yields by adult fish migration outside MPAs was found in Japan (Yamasaki and Kuwahara, 1990) and coincidentally in the Philippines (Russ and Alcala, 1996a). However, only very few studies have established proof of migration (e.g. Russ and Alcala, 1996b). Furthermore, benefits attributed to migration are observed at distances less than 1 km from the boundaries of the MPAs (Roberts and Polunin, 1991, DeMartini, 1993, Russ and Alcala 1996a, 1996b). In addition, the migration of larger, slow growing species, have been observed (i.e. the export rate has exceeded the rate of removal) only 8 to 11 years after an MPA's establishment (Russ and Alcala, 1996 a, b).

Evidence of fisheries replenishment through recruitment has been even more difficult to observe (Lauck *et al.*, 1998, Allison *et al.*, 1998). Differentiating between environmental variability and MPAs' impact is still often impossible (Larkin, 1996, Lauck *et al.*, 1998) and the relationship between stocks and recruitment is rarely taken into consideration. This might explain why MPAs' benefits to surrounding fisheries in terms of recruitment have failed to be shown (Carr and Reed, 1993, Roberts, 1997, Allison *et al.*, 1998).

- ***The efficiency of NTZs would be determined by their size, design and location***

The aim of NTZs is to promote the sustainable use of fishing resources. One way to do this is to protect the spawning areas of the exploited fish species to replenish the surrounding fisheries. The design and location thus condition NTZs' efficiency as larval dispersal is at the root of replenishment through recruitment outside NTZs and is highly affected by the local variability of the ecosystems (Carr and Reed, 1993, Man *et al.*, 1995, Allison *et al.*, 1998). Features such as currents, tides, eddies but also seasonal variations and larger global scale variations (i.e. El Niño oscillation)



influence the movement of larvae (Carr and Reed, 1993, Allison *et al.*, 1998). Larval development and behaviour also affect their dispersal (Carr and Reed, 1993).

Environmental factors, reproduction modes, development and behaviour patterns determine the distance and direction of larvae dispersal. Thus, the success of NTZs in replenishing fisheries depends also on the understanding of these patterns; on identifying which area will act as a source or as a sink for recruitment (Carr and Reed, 1993, Dugan and Davis, 1993, Russ, 1996, Allison *et al.*, 1998). The location and size of NTZs are critical success factors and should be determined according to the replenishment patterns of the fish stocks.

These patterns of replenishment have led to raise questions about the appropriate size and number of NTZs and take on board the 'single large or several small' (SLOSS) debate first developed for terrestrial reserves (Soulé and Simberloff, 1986). Different patterns have been identified (Carr and Reed, 1993, Allison *et al.*, 1998). The most common for coral reef fisheries, is that multiple population sources replenish a common pool of short-lived larvae (not travelling far). In such case, 'several small' (SS) NTZs within reach of each other are believed to be the best option to guarantee replenishment, they would maximise the interior-exterior species interactions (Buechner, 1987, DeMartini, 1993). The 'single large' (SL) design would be more appropriate for biodiversity conservation, as by minimising the perimeter to area ratio, 'hot spots' of human impacts can be relatively isolated (Carr and Reed, 1993, Allison *et al.*, 1998). In addition, species' movement can be limited by habitat preferences and by natural boundaries (e.g. channels) which affect the permeability of NTZ edges (Buechner, 1987, DeMartini, 1993). To be effective, design and location should take into consideration the habitat preferences at different development stages of the fish (Carr and Reed, 1993) and natural barriers (Allison *et al.*, 1998).

Thus, designing appropriate NTZs is a complicated process. Most of the processes (e.g. environmental, replenishment patterns, reproduction modes) determining larval dispersal are still not fully understood (Carr and Reeds, 1993, Roberts and Polunin,

1996, Larkin, 1996). Moreover, the fish stocks' replenishment patterns are specific to each species. This adds a difficulty for the management of coral reef fisheries through NTZs. Coral reef fisheries being multispecific, priority stocks would have to be chosen (Allison *et al.*, 1998).

Difficulties are increased by the fact that the inside and the outside of NTZs are irremediably linked. Hence, as much as NTZs can be efficient for heavily fished stocks (DeMartini, 1993, Holland and Brazee, 1996), they could not eliminate the requirement for other fisheries or marine resource management methods outside their area (Allison *et al.*, 1998, Lauck *et al.*, 1998).

- ***NTZs: use of the precautionary principle for sustainable fisheries***

The lack of evidence of MPAs' benefits on surrounding fisheries yields might stem from the fact that current MPAs have mainly been designed and located for tourism and conservation. However, it is now known that the transfer rates between inside and outside of an MPA depend on the target species (DeMartini, 1993), the larval dispersion patterns and on the physical environment, all of which determine the best NTZ location, size and design (Carr and Reed, 1993, Allison *et al.*, 1998).

In uncertain environments (i.e. financial, biological), risk reduction is achieved by bet hedging and diversifying strategies (Yoshimura and Clark, 1993). By having opened entire stocks to exploitation under high uncertainty levels, it is believed that risk reduction strategies have not been applied to the fisheries management domain. Thus, stocks have been put at risk (Lauck *et al.*, 1998). Because of the limits of our understanding, NTZs are thought to be the safest and less risky way to prevent overfishing and should be used as a precautionary measure against stock depletion (White *et al.*, 1994, Russ, 1996, Lauck *et al.*, 1998).

Uncertainty does not only touch the biological environment. The political and social issues associated with NTZs' establishment might not allow the best design in terms of ecological efficiency to be implemented (Carr and Reed, 1993, Allison *et al.*, 1998).



## **2.2 MPAs' COSTS AND BENEFITS FROM STAKEHOLDERS' POINT OF VIEW**

NTZs' design and location are important for their success. Equally as important are the social and political context in which they are established and, the effectiveness of their management (Carr and Reed, 1993, De Martini, 1993). Inappropriate management and poaching have been identified as the most important threats to PAs in general (IUCN, 1994).

Involving stakeholders in the management of MPAs is believed to increase their chances of success (Salm and Clark, 1984, White *et al.*, 1994, Christie and White, 1995, Gubbay, 1995, Salm and Price, 1995, Salm and Ngoile, 1998). However, community participation can be difficult to achieve as MPAs reduce access to already limited marine resources. If NTZs are to be a coral reef fisheries management tool and stakeholders need to be involved, there also need to be convincing arguments for communities to participate (*White et al.*, 1994, Borrini-Feyerabend, 1998, Cocklin *et al.*, 1998).

### **2.2.1 Enforcement of MPAs and community involvement**

Sustainable use of resources is more about managing people than managing resources and effective enforcement is paramount to their eventual success.

#### **2.2.1.1 MPAs on the ground, success and failure**

There were 850 MPAs throughout the world in 1993 (Elder, 1993). Good enforcement is essential for MPAs to be a success in terms of biodiversity conservation, tourism recreation, and, in the case of NTZs, permanent enforcement is critical to the achievement of larval replenishment (Carr and Reed, 1993, Lauck *et al.*, 1998). Although NTZs are thought to be easier to enforce than other fisheries

management tools (Bohnsack, 1993) up to now, MPAs have not always confirmed this and a number have become 'paper MPAs' (Causey, 1995). In 1988, only 16% of the MPAs established in the Wider Caribbean region outside the USA jurisdiction were well managed (Smith, 1994, Causey, 1995). In the Western Indian Ocean region, a study examining the management of 41 MPAs gazetted concluded that it varied from good to none for Tanzania, Mauritius and Madagascar (Salm and Ngoile, 1998).

Enforcement failures have been linked to diverse factors such as lack of awareness, public apathy, low priority, lack of funding and lack of government commitment/support (Salm and Ngoile, 1998), inappropriate legal and institutional framework, (Cole-King, 1995, Gibson and Warren, 1995, Cocklin *et al.*, 1998), lack of trained personnel and lack of planning (Kelleher and Kenchington, 1992, Salm and Ngoile, 1998, Hockins, 1998). Effective community involvement has appeared to be critical (White *et al.*, 1994, Wells and White, 1995, Christie and White, 1997, Smith, 1994, Salm and Ngoile, 1998, Cocklin *et al.*, 1998). In a pilot study, Alder (1996) found that community involvement was as highly correlated to perceived MPA success by the respondents as other factors (i.e. funding, legislation, staffing).

#### **2.2.1.2 Is stakeholders' participation the answer for successful MPA management?**

Experience suggests that without communities' support, MPA enforcement is much harder and often fails (White *et al.*, 1994, Fiske, 1992, Valdes-Pizzini, 1995, Salm and Ngoile, 1998).

Coastal communities are often highly dependent on marine resources for their livelihoods and food security. Thus, they are likely to be affected by the establishment of MPAs which challenge their traditional user rights and the socio-cultural context within which they determine access to the resources (Fiske, 1992, Cocklin *et al.*, 1998). Hence, when MPAs are implemented without appropriate consultation, the reactions of concerned communities are often been strong and even



violent (e.g. in Diani - Kenya (King and Malleret-King, 1997), Kisite-Kenya (Glaesel, 1997), La Parguera-Puerto Rico (Valdes-Pizzini, 1995)). In Diani for example, the inappropriate consultation of the communities added to a complex political situation resulting in the fishers burning the MPA authorities' buildings in protest to the establishment of the MPA in 1995. To this day, the MPA exists on paper but is not enforced (Malleret-King, 1996, King, 2000).

Participation is now accepted as paramount to a long term vision of resource management and conservation. In the case of MPAs, it is believed to promote understanding and education, to reduce costs by improving enforcement and compliance thus improving resource conservation (Borrini-Feyerabend, 1998). But, however beneficial, community involvement is not achieved easily. Due to the lack of acknowledgement of communities' heterogeneity (Leach *et al.*, 1997) and the difficulty of finding a balance between local initiatives and government commitment, results have often been disappointing.

Contrary to the *de facto* assumption that they are distinct and homogenous entities, communities are composed of different social and activity groups, the objectives of which can vary and be in conflict (Borrini-Feyerabend, 1998). For example, marine resource users can comprise tourists, tour operators, subsistence fishers, sports fishers, yachtsmen, local residents etc. all of whom will have different interests and stakes in the marine environment (Wells and White, 1995). Divers and fishers have a direct interest in the conservation of the reef, but whereas the former will be able to operate in an NTZ, the latter will see the access to their food resources reduced in the short term at least. Their reaction to the establishment of an NTZ will thus differ. One of the difficulties of setting up an NTZ with the communities' participation is to identify and involve all user groups (including the ones which might not be located in the direct vicinity). Different user groups might be relatively easily identified but social differences, which need to be understood, might be subtler. They are hence often not emphasised enough (Smith, 1994, Davis and Bailey, 1996, Leach *et al.*, 1997, Cocklin *et al.*, 1998).

Not taking account of communities' heterogeneity has resulted in the failure to involve certain user groups. Often, the groups most in favour of MPAs are the only ones involved, even though they are likely to represent the opinion of a small minority. In St Lucia for example, involving only diving operators, meant that other stakeholders (i.e. fishers) did not support the recently established MPA and were more likely to challenge its enforcement (Smith, 1994). Furthermore, it can be difficult to understand people's attitudes towards MPAs as, in some societies dominated by elites, certain groups (e.g. women, the poor) must be empowered before being able to express their concerns (Davis and Bailey, 1996, Leach *et al.*, 1997, Cocklin *et al.*, 1998). If all user groups are not made part of the process, resentment and misunderstanding may grow, thus compromising participation and consequently the MPAs' enforcement.

In addition, community initiatives call for a new role for the central government which extends beyond the essential financial role (see Geoghegan, 1994, Taylor, 1998). As much as social control and local enforcement can work better at the local level than at a centralised level, they can easily be challenged by outsiders on whom social pressure has no power. For example, migrant fishers can ignore local rules; not being part of the local social set-up, they do not have to fear the consequences of their actions (White, 1994, King and Malleret-King, 1997). Hence, it is important for the central government to express its will to commit to and support community initiatives (Cocklin *et al.*, 1998) as the lack of recognition and support can lead to failure. This was the case in Honduras, where a community initiated MPA collapsed as a result of the actions of 'outsiders' (Luttinger, 1997). Although the MPA was recognised by the governmental institutions at the local, regional and national levels, there was no formal delegation of power or commitment from these institutions. Thus, no action was taken to stop the outsiders breaking the MPA's rules. Support and commitment have to be given to community initiatives as well as formal recognition and status (White *et al.*, 1994, Luttinger, 1997).

A good understanding of the way in which resource use and access are determined, of the different production systems defining activity groups, and of the power



relations within communities is essential to achieve community participation. Recently, top-down approaches to MPA establishment have undergone changes towards reversing the process and promoting bottom-up approaches. However, this takes time and numerous pitfalls must be avoided.

### **2.2.2 Evaluating MPA benefits from the stakeholders' point of view**

Choosing a site, planning, managing, enforcing and monitoring are all essential steps for successful MPAs (Salm and Clark, 1984, Salm and Price, 1995). It is argued however that due to financial constraints and to the lack of well defined objectives (Hockins, 1998) the monitoring and evaluating processes are often not implemented. It was mentioned earlier that the lack of historical data makes it difficult to evaluate the performances of MPAs in biological terms. Economic assessments also acknowledge some difficulties.

#### **2.2.2.1 Economic benefits and costs of MPAs and the question of their distribution**

Economic benefits of PAs and MPAs include job creation, support for economic development through consumptive (i.e. fishing) and non consumptive uses (i.e. tourism), foreign currency earning, future benefits through the maintenance of genetic and biological diversity, and opportunities for research, education and monitoring (Dixon and Sherman, 1990, Dixon *et al.*, 1993). The costs of MPAs are easier to identify, they include the costs of establishment, management and enforcement, indirect costs (i.e. resulting from activity conflicts) and the opportunity costs (i.e. the lost revenue) (Wells, 1992, Dixon *et al.*, 1993).

Costs and benefits of environmental protection can be difficult to quantify. This is the case for benefits/costs relating to non-rival goods (i.e. air, water, non consumptive use of MPAs) and goods characterised by non-excludability (i.e. fishing), as in both cases the users do not need to reveal their preferences. Positive

externalities (i.e. cleaner water for surrounding communities) and benefits to future generations are also very difficult to quantify (Dixon and Sherman, 1990).

Because their value cannot be derived from the market, the positive effects of maintaining ecological processes (e.g. shore protection by healthy coral reefs) are believed to have been underestimated and efforts are being made to value them economically (Costanza *et al.*, 1997). Similarly, the costs of environmental protection, particularly the opportunity costs are thought to be underestimated. According to Norton-Griffiths (1998), the price paid for wildlife conservation is nowhere near the value necessary to incite the population to conserve wildlife. He estimated that the net opportunity cost of not developing land for agriculture amounts to 26 millions USD for the Masaai in Kenya, a loss which is not compensated.

Cost/benefit analysis is the most widely used method for evaluating MPAs in economic terms. Through such analysis it has been shown that MPAs bring enormous benefits through tourism (Dixon *et al.* 1993). In 1981, it was estimated that the costs of the Virgin Islands National Park were more than ten times lower than the benefits (Dixon, 1993). Moreover, studies show that potential revenues from tourism could be improved as visitors are willing to pay higher entrance fees (Dixon *et al.*, 1993, Moran, 1994). However, the potential for tourism increase is constrained by the carrying capacity of the environment. For example, in Bonaire marine park (Caribbean) damage from divers have already been observed. In order for these effects not to have a backlash on the park's revenue, diver quotas should be established (Dixon *et al.*, 1993).

If the economic benefits of MPAs can be high so why are resource users still reluctant to establish MPAs? Economic assessments are made on a national or regional basis and fail to take account of social impacts, subsistence production and of the distribution of costs and benefits. Distorted distribution of costs and benefits of wildlife protection is illustrated by the Masaai's high opportunity costs whilst it is estimated that as little as 1% of all revenues collected from PA related tourism go to



the local landowners (Norton-Griffiths, 1998). MPAs as PAs are established for humankind as a whole, not for the realisation of local values (Hough, 1991) and Wells (1992) observed that whilst the protection benefits increase from local to global levels, costs follow a reverse pattern and increase from global to local levels. The fact that non monetary assets at the local level are underestimated and sometimes impossible to evaluate adds further distortion.

The unequal distribution of the benefits and costs of environmental protection is probably one of the main reasons for communities rejecting MPAs. Cost/benefit analyses often undervalue social impacts (Barrow, 1997) which can, if severe, jeopardise communities' compliance (Clay and Dolin, 1997).

#### **2.2.2.2 Social Impact Assessments (SIA)**

SIAs have been used for a long time in relation to terrestrial resources (Vanderpool, 1987, Jacobson, 1991, Clay and Dolin, 1997). Only recently have they been adapted to fisheries and MPAs (Clay and Dolin, 1997, Cocklin *et al.*, 1998) and been made compulsory by the American National Environmental Agency in the context of fishery management plans (Clay and Dolin, 1997).

SIAs concentrate on the impacts of policies on established social relationships, structures, patterns of authority and networks (Vanderpool, 1987). Even though recognised as important, they are treated as the last requirement and do not get the necessary finances to establish a strong enough knowledge base (Clay and Dolin, 1997). The lack of baseline data makes it difficult to compare situations and separate changes triggered by social dynamics from changes resulting from the implementation of a specific policy (Vanderpool, 1987). SIAs are useful to assess stakeholders' attitudes towards the presence of an MPA, as was done for the Hei and the Leigh marine reserves in New Zealand (Cocklin *et al.*, 1998). Understanding users' opinions through interviews and questionnaires, can help managers to estimate the stakeholders' likely level of compliance.

However, although they are useful to monitor social impacts, SIAs are not tools for evaluation; their aim is not to assess the performance of an action (i.e. the establishment of an MPA) but to predict unwanted effects of this action and advise on alternative actions (Hough, 1991). On the other hand, economic assessments fail to grasp the inequity of the access to benefits at local levels.

In order to participate in the establishment and management process of an NTZ, communities need to see benefits that they can refer to. In the case of NTZs it could be the improvement of their food security through fishing yield increases. To assess NTZs' performances and convince stakeholders of their benefits, a holistic approach must be used taking into consideration the distribution of benefits between the different user groups. The concept of household food security could help us achieve this aim.

#### **2.2.2.3 Food security: another way to look at the impacts of MPAs on local communities**

As already indicated, food security is understood as *'that state of affairs where all people at all times have physical and economic access to adequate, safe and nutritious food for all household members, without undue risk of losing such access'* (FAO, 1996a). The concept of household food security goes beyond a market orientated economic vision and takes into account the distribution and access to food resources, thus incorporating social processes, at local and household levels.

At the same time as the concept of food security has evolved in the last 30 years, indicators of food security/food insecurity have been developed. Available indicators and their limits are presented in Chapter 6. Food coping strategies are defined by Davies (1993) as *'short term temporary responses to declining food entitlements'* and are widely used socio-economic indicators. The idea behind them is that households, when facing a crisis, use a combination and succession of coping strategies in order to stay food secure and to maintain their livelihoods systems (Swift, 1989, Davis, 1993). Identifying the strategies used can help to estimate how

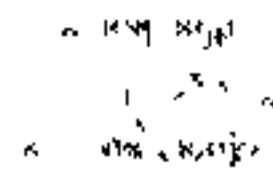


severely households have been hit by a crisis (Corbett, 1988, Maxwell and Frankenberger, 1992, Maxwell, 1996).

In addition, coping strategies have been used to measure and compare the food security situation of different types of households. In Uganda, for example, an index based on the severity and frequency of coping strategies helped to establish that households cultivating urban gardens were more food secure than households which did not (Maxwell, 1996). A similar, but adapted index will be used to assess the impacts of the Kisite Marine National Park (KMNP) in Southern Kenya, on surrounding fishing communities. The aim is to see whether households with close links to the MPA are more food secure than the others. The reason for better food security could be improved fishing yields or benefits from tourism. The household food security angle should enable the MPA to be looked at from the communities' point of view, using measures they can relate to, and take into consideration non market resources and activities.

As it will be discussed in Chapter 4, the methods used during the one year field work to study KMNP from the stakeholders' point of view were as much as possible participatory (Chambers, 1992). They involved semi-structured, in depth, formal and informal interviews as well as focus groups (see Slocum *et al.*, 1995, Bernard, 1995). Oral questionnaires were also used. Village meetings were organised to introduce the research and enabled me to meet some key informants. Five research assistants (women) were employed. Key informants (mostly men) were met regularly and informally interviewed mostly about the history of the area. Six women were interviewed in depth and 210 households randomly selected were surveyed twice. Household informants were women. They were considered to be the most appropriate to talk about household food coping strategies as they are in charge of food preparation. The site is described in chapter 3, the process of selecting informants and the methods used to collect information are introduced chapter 4 and detailed in the relevant chapters.

### 2.2.3 Conclusions



Coral fisheries are experiencing a crisis which threatens the food security of millions of people. MPAs' observed ecological benefits have led scientists to believe that they could be the best way to use the precautionary principle in fisheries management.

However, MPAs are more about managing people than natural resources. Along with appropriate design and location, one of the essential conditions for NTZs success is their effective enforcement, the respect of the ban on extractive use by the users. Experience has shown that in order to be well enforced, it is essential for MPAs to be accepted and supported by affected communities. These communities are often against the establishment of MPAs which challenge their traditional rights whilst not having obvious benefits to them.

Biological studies have rarely been able to establish evidence of MPAs' benefits to surrounding fishing communities through improved fishing yields and, although cost/benefits analyses have shown MPAs economic benefits at regional/national levels, they often cannot grasp the complexity of the local levels. Up to now, no method has been able to evaluate the performances of MPAs for the surrounding local communities. I suggest that the concept of household food security might help us to determine if surrounding fishing communities benefit from the establishment of MPAs and potentially from NTZs.



## **3 The study sites**

### **3.1 INTRODUCTION TO THE KENYAN COAST**

This section aims at presenting the coast of Kenya in a geographic, demographic, economic and historic context. This will contribute to the understanding of the current situation of the study site.

#### **3.1.1 Geography and economics**

##### **3.1.1.1 Geography and people**

Bordered by Tanzania in the south, Uganda to the west, Sudan to the north west, Ethiopia to the north, Somalia to the north east, and the Indian Ocean to the east. Kenya's territory spreads 4° North and South of the Equator. The country can be divided into 6 natural regions, the north arid plains, the fertile up country which is the main agricultural region, the Rift Valley, Western plateaux and the low plateau region bordering the coastal strip (Vanden Berghe, 1990). Administratively, it is divided into 7 Provinces divided in 38 Districts themselves divided into Divisions, Locations and Sub-Locations (GK, 1996).

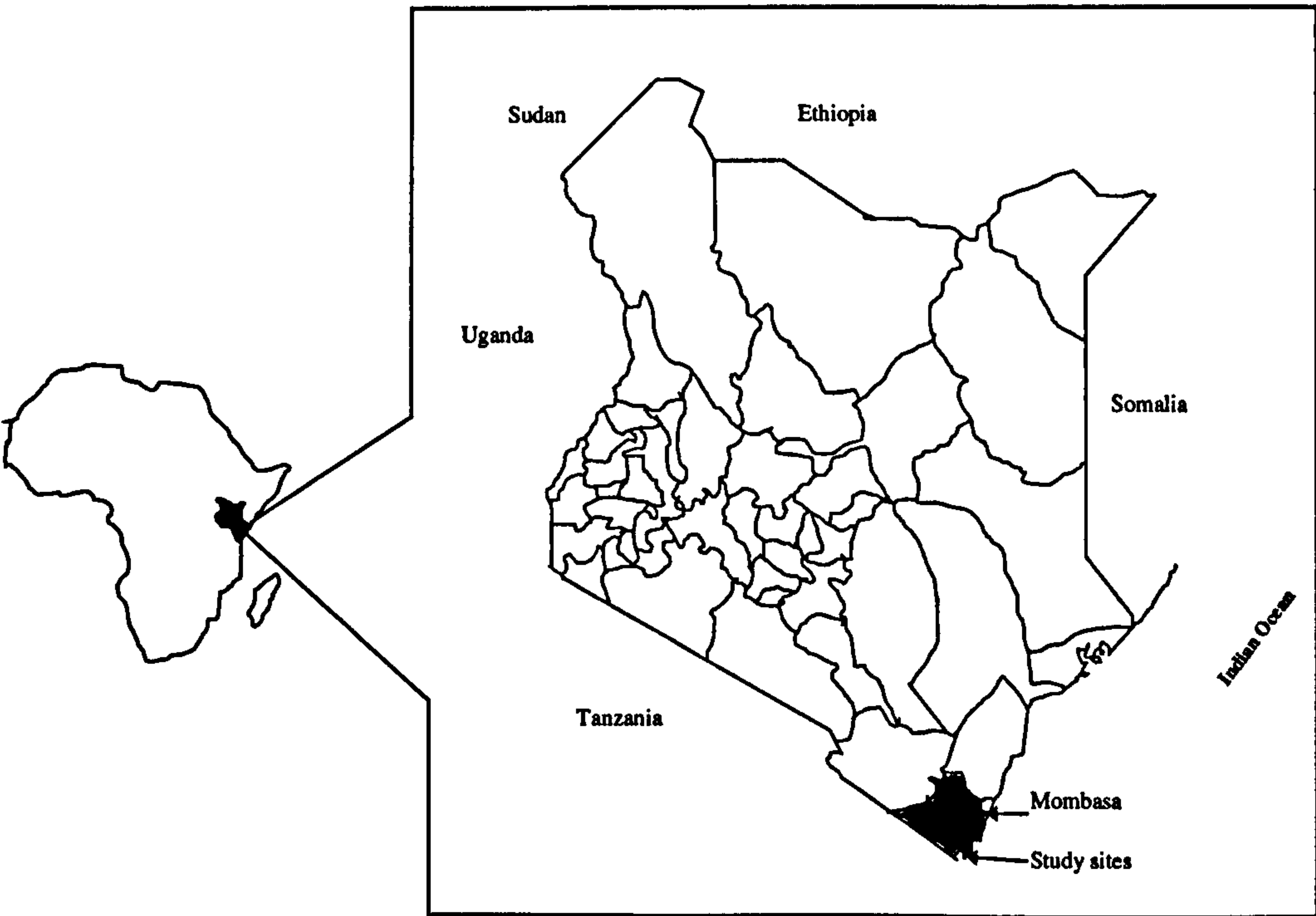
Kenya is a segmented country geographically and demographically. In 1997, its population was estimated to be 29.6 millions (EIU, 1998) of which 90% were African and belonged to 38 different tribes. The remaining 10% were made up of Asians (Indians), Europeans, Swahili and Arabs. On the coast, Mijikenda<sup>3</sup> and

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<sup>3</sup> The Mijikenda are composed of nine tribes: the Chonyi, Digo (found on the southern coast), Duruma, Giriama, Jibana, Kambe, Kauma, Rabai and Ribe. Although distinct they all are of Bantu origin and share similar cultural and linguistic characteristics (Vanden Berghe, 1990).

Swahilis are the dominant groups. Thirty languages or dialects are spoken as well as English and Swahili, the official language (Vanden Berghe, 1990). This varied population is unequally distributed on the territory with 50% of it concentrated on 6% of the high potential land (EIU, 1998). The highest densities, (over 200 inhabitant/km<sup>2</sup>), occur around Lake Victoria and along the coast (Vanden Berghe, 1990). The Coast Province concentrates 9% of the total population on 15% of the Kenyan territory (GK, 1994).

The Kenya African National Union (KANU) has been the ruling party since the independence of December 1963. After the death of Jomo Kenyatta in August 1978, Daniel Arap Moi was elected president. Since then, he has been “democratically” re-elected twice (1992 and 1997). Although the bases for democracy are being laid down, it is a slow process and the political troubles of both election periods have illustrated the tense political situation (EIU, 1998).



**Figure 3.1: Map of Kenya and its Districts**



### 3.1.1.2 A prevailing primary sector

Although the urban population is increasing rapidly (a 62% increase in Nairobi between 1969 and 1979, and 38% in Mombasa), 87% of the Kenyan population is still rural (Vanden Berghe, 1990). In 1997, agriculture represented 30 % of the GDP (EIU, 1998). The agricultural sector is oriented towards exports, mainly coffee, tea and a recent horticultural boom (EIU, 1998). Commercial crops on the Coast include coconut, coprah, bixa<sup>4</sup> and nuts (GK, 1994). Even though policies focus on commercial agriculture, subsistence agriculture is widely spread. Upcountry, wheat and maize are the main subsistence crops whilst on the coast, maize, cassava and pulses dominate (Vanden Berghe, 1990, GK, 1994).

The agricultural sector's main problem is scarcity of land. High potential areas are already being used and people, in order to cultivate, have to migrate to less productive areas (EIU, 1998). On the coast, land scarcity is an acute problem particularly because of the development of non agricultural land uses (e.g. tourism) that have constituted an international land market from which local people are excluded (Ng'weno, 1995, Malleret-King, 1996). More and more, inheritance has become the only way of acquiring land for local people (Ng'weno, 1995, Mwadime, 1996). Thus, divided plots are often too small to support households and their productivity is reduced by their heavy use (Malleret-King, 1996).

The land problem is one of the reasons why coastal households increasingly depend on marine resources for their subsistence (King and Malleret-King, 1997). On a national scale the marine fishery does not represent an important sector. It does not bring nearly as much income as the well developed Lake Fisheries (Sanders *et al.*, 1988) but for coastal people it is essential. Still mostly artisanal, the fishery is associated with the nearly uninterrupted 600 km of barrier reef. The estimated catch is 16000 t/year for 8000 fishers (Sanders *et al.*, 1988). In Kwale District (location of our study site) 5000 people were estimated to live off fishing activities in 1994 (GK, 1994). However, through the study in 1996 of the production systems of a fishing

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<sup>4</sup> Red flower used to make a natural dye.

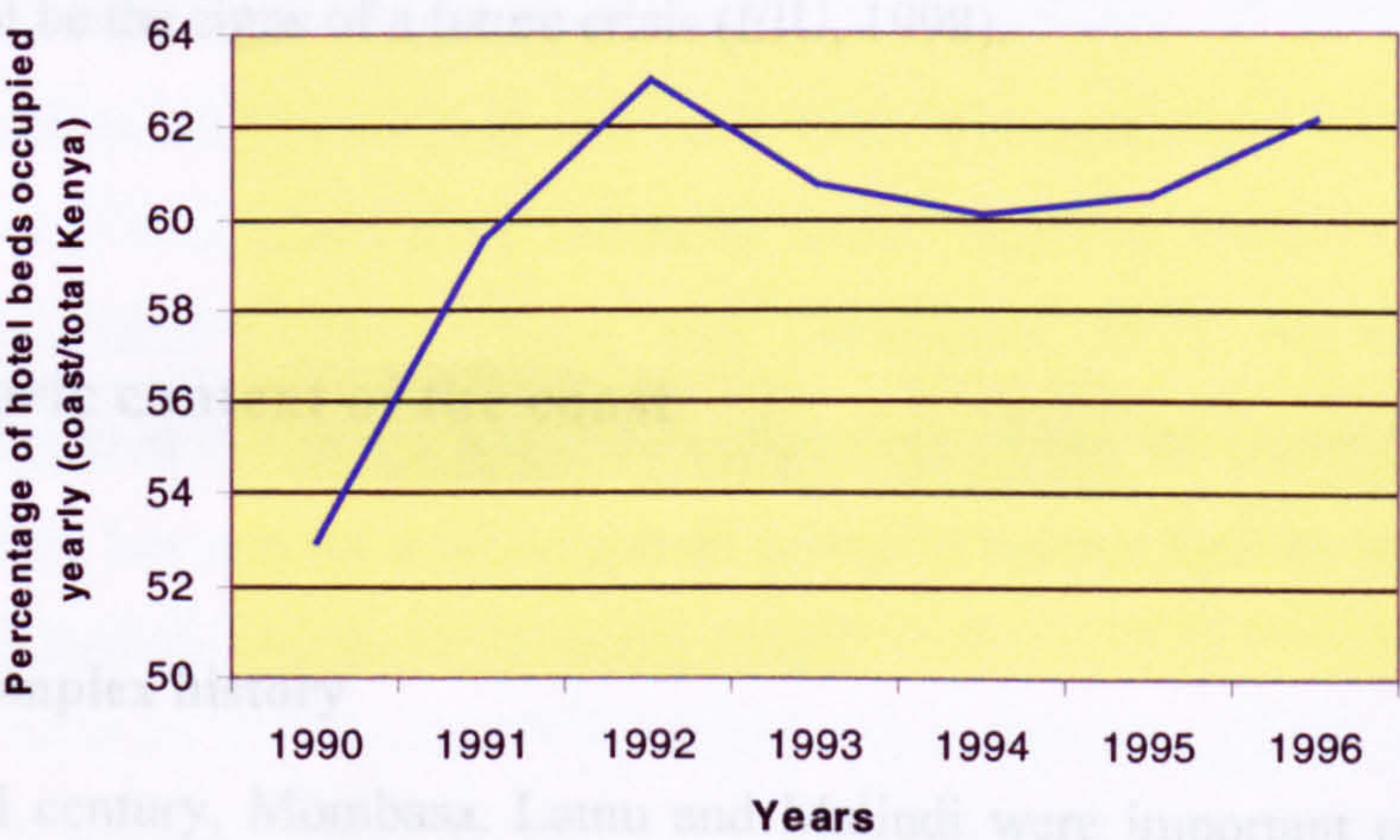


community in Diani (Kwale District) it was estimated that 8000 people depended on the fishery attached to this 20km long stretch of reef (Malleret-King, 1996). Because of the relatively little available information on this fishery, statistics can vary greatly. However, a consensus exists on the fact that Kenyan reefs show signs of overexploitation (i.e. decrease in the perceived catch, increase in sea urchin population) (Samoilys, 1988, Wells and Sheppard, 1988, McClanahan and Muthiga, 1988, McClanahan and Obura, 1995, Watson, 1996, Glaesel, 1997, Muthiga, 1998).

As in numerous other nations, the coral reef fishery is not considered as a priority by the Kenyan government. This lack of interest could be linked to the relatively small revenue it represents in comparison to other sector. It could also be due to the segmentation of a country in which the administrative and political power has little to do with the coast.

**3.1.1.3 A growing service sector**

Tourism represented 14% of the export benefits and 6% of the GNP in 1997 (GK, 1997). Since the 1970's tourism has increased constantly (GK, 1997). First developed around the wildlife and the terrestrial reserves, the white beaches have now become an attraction too as figure 3.2 illustrates.



**Figure 3.2: Development of coastal tourism since 1990 measured in percentage of hotel beds occupied at the coast in relation to the total number of hotel beds occupied in Kenya (source: GK, 1997)**



There were 27 beach hotels in Kwale District in 1994 (GK, 1994) but the infrastructures and planning have not kept pace with these rapid developments (e.g. no mains water, little sewage treatment (pers.obs.)) (EIU, 1998).

#### **3.1.1.4 Nutrition and food security on the Coast**

According to the national survey of 1994 absolute poverty<sup>5</sup> in rural areas has stayed stable since 1992 (around 46.7% of the surveyed households for 1992 and 1994) (GK, 1997). However, the situation is location specific. On average, rural absolute poverty in the Coast Province increased between 1992 and 1994. From being less poor than the national average in 1992 the situation worsened and, in 1994, there were much more absolute poor on the coast (53.6%) than in Kenya as a whole (46.7%). Similarly, in Kwale District, the percentage of rural absolute poor households increased from 26.5% in 1992 to 40.2% in 1994. However, both years the District was better off than average both at the provincial and national levels (GK, 1997).

Although the main sectors of the economy are stable, land scarcity, fisheries overexploitation, the deterioration of national infrastructures and the increase of poverty might be the signs of a future crisis (EIU, 1998).

### **3.1.2 Historic context of the coast**

#### **3.1.2.1 A complex history**

In the second century, Mombasa, Lamu and Malindi were important ports on the Indian Ocean trade routes (see Hall, 1996). They have been Kenya's main gates for

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<sup>5</sup> Rural absolute poors: household living under the rural absolute poverty line which takes into consideration the food and non-food basic requirements (i.e. health, education) in monetary terms (GK, 1997: 35).

a succession of external influences, Greeks in the 1st century, Arabs/Omanis from the 7th century, Portuguese in 1498, finally, British in 1828 (Martin and Martin, 1983, GK, 1988, Hall, 1996). Internal influences came with the Bantu population as they migrated from the Zambezi valley (starting around the 11th century) and settled along the coast massively in the 15th-17th centuries (Spear, 1978). Because of adverse conditions, exchanges with inland Kenya only started in the 19th century (Martin and Martin, 1983).

The current cultural and socio-economic characteristics of the coast are the product of these mixed influences. Thirteen centuries of Arab and Omani domination have left a specific socio-cultural organisation and a distinct population, the Swahili<sup>6</sup>. On contact with the Swahilis, the Mijikenda (particularly the Digo) adopted this cultural model and progressively converted to Islam (Vanden Berghe, 1990). They dropped their traditional matriarchal structures for a social order based on the *Liwalis* (Islamic judges) (Ng'weno, 1995). Islam is now the predominant religion on the coast, whilst the rest of Kenya has a Christian majority (Vanden Berghe, 1990).

The Arab and Omani influences did not stop with the arrival of the British in 1828 even though the Swahili plantation economy was destroyed by the abolition of slavery introduced by them in 1832 (Vanden Berghe, 1990). During the colonial regime (1850-1963), the coastal strip<sup>7</sup> stayed a Protectorate of the Sultanate of Zanzibar to which the Crown paid rent until 1963. The agreement was that unlike 'natives', who at best could have access to native reserves, Muslims could have access to individual property (Cone and Lipscombe, 1972, Ng'weno, 1995). Massively converted to Islam in the 1930's (Sperling, 1988), the Digos exploited the ambiguity of the law and for a while gained access to reserve land as natives and to individual property as Muslims (Ng'weno, 1995).

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<sup>6</sup> The Swahilis are the result a the mix of Omani, Arab and Bantu ethnic groups. They became a distinct and 'homogenous' populations in the XVIth century (McKay, 1975).

<sup>7</sup> The coastal strip represents a band 16 km wide from the sea.



The colonial regime heavily marked Kenya and particularly the coast. First, by building the railway linking Mombasa to Kisumu, the British were responsible for the transfer of economic activities from the coast to the highlands which are today, still, the nervous system of the country. Secondly, they left behind administratively and politically centralised systems which enable a minority to rule (EIU, 1998). Moreover, by having appointed village representatives they have ended the traditional social organisation based on social consensus (Martin and Martin, 1983). This legacy is thought to have had repercussions on the management of natural resources (King and Malleret-King, 1997).

### **3.1.2.2 The question of land**

Landlessness is widespread, particularly on the Coast (Ng'weno, 1995). This phenomenon is a result of the historical process. Land was the main factor of the British colonisation in Kenya. The British spread inland after having completed the railway linking the Kenyan Coast to Uganda (Martin and Martin, 1983, Vanden Berghe, 1990). By 1926, the fertile highlands had become exclusively white (Ng'weno, 1995). The Crown Lands Ordinances (1902) gave the Queen power of control on unoccupied (or seemingly unoccupied) land and removed the possibility of acquiring land through clearance, which was traditional (Ng'weno, 1995). Progressively the access to land was determined by ethnicity as suggested in the previous section; Europeans had exclusive access to the fertile Highlands, Asians could only own land on the coast and for the Africans access to land was limited to the native reserves established from the 1910s (Martin and Martin, 1983, Vanden Berghe, 1990, Ng'weno, 1995).

Africans had become tenants of the Crown on their own land, thus, it is no surprise that protests arose as soon as the 1910s (Cone and Lipscombe, 1972). The protests peaked at the beginning of the 1950s with the Mau Mau. However, the violence of the fight for freedom did not reach the coast (Martin and Martin, 1983). The end of the violence signified the start of a new era and the beginning of the way to independence. Agrarian reforms were put in place with the Swynnerton plan

published in 1957 (Cone and Lipscombe, 1972). The aim of these reforms was to accelerate agricultural development in African zones particularly through the promotion of individual property rights (Cone and Lipscombe, 1972). With this plan, 1.3 million acres were redistributed to African families in plots of 10 acres (Ng'weno, 1995). However, the reforms concentrated on the highlands and were slow to reach the Coast (Ng'weno, 1995).

The independent government continued the changes started by the colonial government and the Swynnerton plan carried on being implemented through the "Native and Land Tenure Rules" of 1956 which set up a process of land adjudication and registration (Cone and Lipscombe, 1972). Crown Lands were turned into State land, and the agricultural policies were continued with help from the British government through the "Million Acre Schemes". This scheme aimed at buying non cultivated land from Europeans and redistributing it to the indigenous population (Ng'weno, 1995).

At independence, the coastal strip became fully part of Kenya under the agreement of "*safeguarding Muslim law and religion and the rights of minorities*" and "*the continuation of freehold titles to land and the freehold system*" (Central Office of Information, 1963:32, quoted in Ng'weno, 1995:47). As mentioned in the previous paragraphs, most policies concentrated on the Highlands, and the independence was the result of an upcountry fight. Thus, although the "Million Acre Schemes" dated from the 1960s, land adjudication only started in 1974-1975 on the coast (Ng'weno, 1995).

Moreover, a tourism boom occurred in Kenya in 1970s and the coastal land attracted the interest of outsiders. Part of the Digo Native Reserve on the South coast was divided and redistributed, the sea front areas were sold or taken (Malleret-King, 1996). Most of the valuable plots were sold to outsiders whether upcountry people or foreigners. This situation created a land market, which excluded the local people, and the main way to access land for them has become inheritance (Ng'weno, 1995, Malleret-King, 1996).



The result of this is that in Districts such as Kwale District as much as 22.5% of the households were landless in 1990 (Ministry of Planning and National Development and UNICEF, 1990 cited in Ng'weno, 1995).

In 1963, the coast became fully part of Kenya. However, independence was the result of an upcountry fight (Vanden Berghe, 1990) and although coastal populations benefited from the land privatisation programs, land distribution often favoured the upcountry tribes in power (Ng'weno, 1995, Malleret-King, 1996). Thus, parts of the coastal strip were given or sold at very low prices to outsiders as tourism was becoming important in the region. This situation combined with upcountry based economic policies are thought to have excluded the coast from the Kenyan development process (Vanden Berghe, 1990).

## **3.2 FEATURES OF THE STUDY SITES**

Kenya has had terrestrial protected areas since the 1930's (Watson, 1996). It also has been at the forefront of marine resource protection and Marine National Parks (MNP) were established as early as 1968 (McClanahan and Obura, 1995). Currently, there are ten MPAs; four Marine National Parks (MNP), and six Marine National Reserves (MNR) (Muthiga, 1998).

### **3.2.1 The study area**

In order to study the impact of an MPA (coral reef area) on the surrounding fishing communities it was necessary to find a site with a long established MPA, identifiable communities, an economic activity dominated by artisanal fishing and relatively easily accessible. The Kisite Mpunguti Marine National Park (KMNP) and Reserve was chosen as the most appropriate site for this research. Gazetted in 1978, the

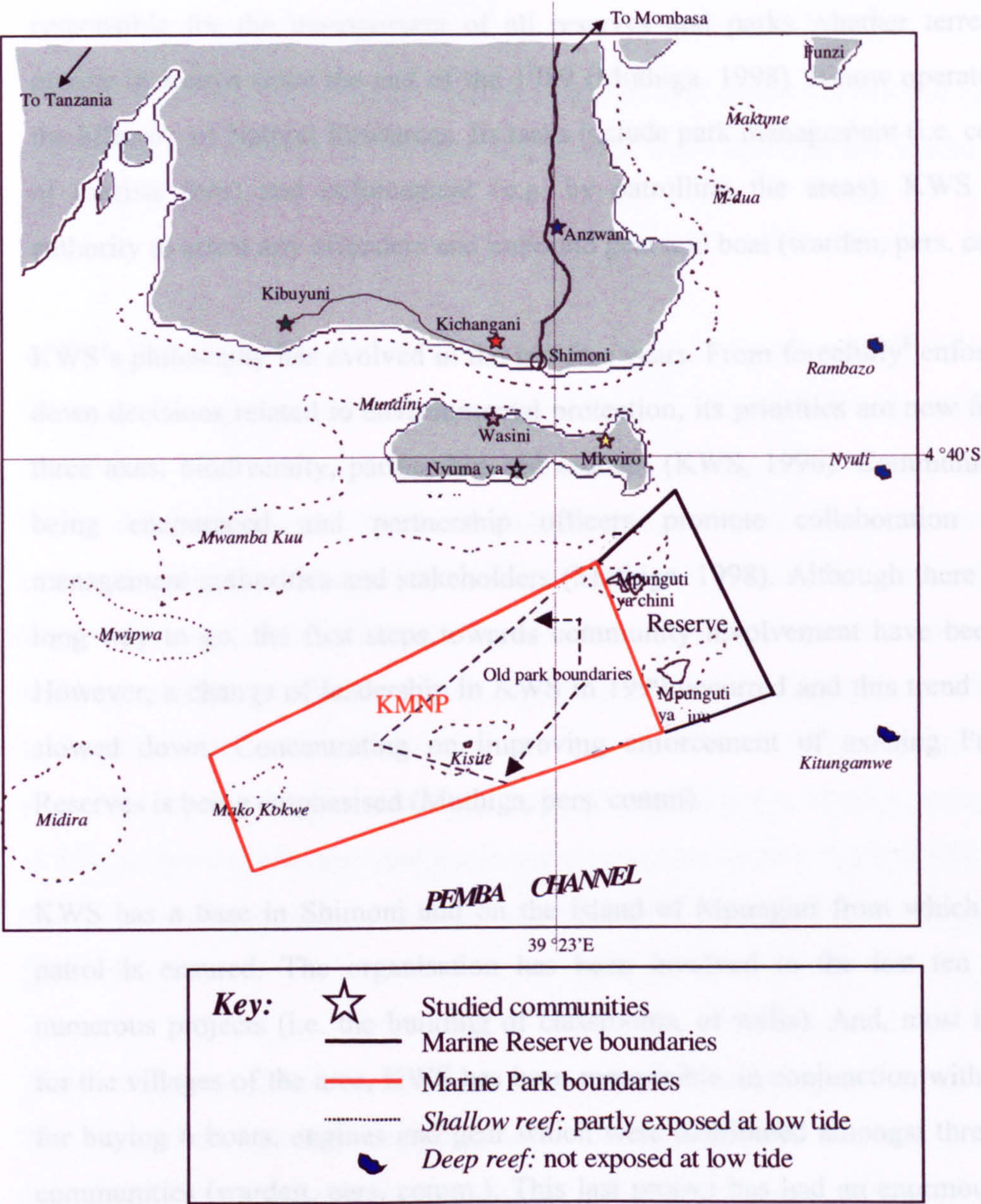
KMNP enabled me to study 20 years of relationship between a MPA and surrounding stakeholders. The main activity is still subsistence fishing in a coral reef associated ecosystem. Tourism exists in the area but is not yet heavily developed, communities could be identified as distinct entities and were accessible.

#### **3.2.1.1 The Kisite Marine National Park (KMNP)**

The study area is located in the Pongwe Kidimu Location of the Msambweni Division, Southern part of the Kenyan coastline, in the District of Kwale. Shimoni, which is the main land base for the KMNP, is 15 kilometres off the main road (Lunga Lunga road), only thirty kilometres from the Tanzanian border. About 700 meters offshore from Shimoni lies the island of Wasini. Altogether the KMNP and the reserve cover an area of 39 km<sup>2</sup> (28 km<sup>2</sup> for the MNP) (Wells and Sheppard, 1988). Kisite and Mpunguti lie about 5km offshore (see fig. 3.3).

In 1978, the whole of the area was established as a MNP. However, under pressure from angry fishermen, Mpunguti, was opened back to fishing in 1988 and turned into a Reserve thus now acting as a buffer zone between total protection and no protection at all (Glaesel, 1997). In these two zones, rules differ. In Parks, no extractive activities are permitted, as in the case of NTZs (i.e. fishing, coral collecting) whereas in a Reserve although use is restricted, traditional fishing is allowed (Muthiga, 1998). The definition of traditional fishing methods is quite vague which sometimes leads to different possible interpretations. On the whole though, fishing with seine nets, spear guns, shell and coral collecting are forbidden in Reserves.





**Figure 3.3: Map of the study site showing the previous and current boundaries of the KMNP and the selected communities**



### 3.2.1.2 The management

The Kenya Wildlife Service (KWS) is a parastatal organisation and has been responsible for the management of all reserves and parks whether terrestrial or marine in Kenya since the end of the 1989 (Muthiga, 1998). It now operates under the Ministry of Natural Resources. Its tasks include park management (i.e. collection of tourists fees) and enforcement (e.g. by patrolling the areas). KWS has the authority to arrest any offenders and impound gear and boat (warden, pers. comm.).

KWS's philosophy has evolved in the last five years. From forcefully<sup>8</sup> enforcing top down decisions related to environmental protection, its priorities are now following three axes, biodiversity, partnership and tourism (KWS, 1996). Communication is being encouraged and partnership officers promote collaboration between management authorities and stakeholders (Muthiga, 1998). Although there is still a long way to go, the first steps towards community involvement have been made. However, a change of leadership in KWS in 1999 occurred and this trend has been slowed down. Concentrating on improving enforcement of existing Parks and Reserves is being emphasised (Muthiga, pers. comm.).

KWS has a base in Shimoni and on the island of Mpunguti from which 24 hour patrol is ensured. The organisation has been involved in the last ten years in numerous projects (i.e. the building of classrooms, of wells). And, most important for the villages of the area, KWS has been responsible, in conjunction with USAID, for buying 6 boats, engines and gear which were distributed amongst three fishing communities (warden, pers. comm.). This last project has had an enormous impact on the acceptance of the KMNP by the surrounding communities.

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<sup>8</sup> KWS was created to deal with elephant poaching. Because of the nature of the work, it adopted military like structure and approach to conservation .



### **3.2.2 Natural resources and seasonality**

In the KMNP area as in the rest of the coast, people depend on natural resources whether marine or terrestrial for their livelihoods. Their activities are conditioned by the region's seasonal climatic patterns.

#### **3.2.2.1 The ecosystem and its uses**

The coastal ecosystem of the area is typical of tropical coastal reef ecosystems and is the base for nearly all activities. Thick stretches of mangroves can be found to the North of Shimoni and on the seaward side of Wasini Island. These forests support varied fauna and notably provide shelter to numerous juveniles of commercial fish species (Anon., 1993). They also provide local communities with firewood and building material. Mangroves are managed by the Forestry Department, which sets limits to the amount of cubic meters cut every year (Anon., 1993). The study site is part of two agro-ecological zones with soils of variable to low fertility, altitudes of 1 to 450 m above sea levels, yearly average temperature of 24 to 26.6°C (GK, 1991). The raised reefs and loam of the area enable local people to cultivate on a small scale (GK, 1991).

Tides of high amplitude have created large areas of reef flats exposed at low tide. The islands are low and composed of fossilised coral and the reefs are mainly fringing and patchy. These are very diverse; 64 genera of corals were found in Kisite whereas the average for the East African reefs is 55 genera (Samoilys, 1988). This coral ecosystem supports the five main commercial demersal fish species exploited by artisanal fishers, groupers (Serranidae), rabbit fish (Siganidae), snappers (Lutjanidae), emperors (Lethrinidae) and parrot fish (Scaridae). Deeper channels allow larger pelagic species such as marlin, sailfish and kingfish to be exploited. These are used not only by local communities but also by sports fishing operations. The Fisheries Department manages fishing activities. The reefs also constitute the base for the non-consumptive uses such as tourism.

The ecosystem provides support for the subsistence of local communities as well as a providing a basis for tourist operations (i.e. through the KMNP). According the survey done in 1993, (Anon., 1993), the resources were not overused then; the coral cover was quite good although damage from anchors, divers and fishing are visible in some parts of the KMNP (Watson, 1996).

### **3.2.2.2 Seasonality and marine activities**

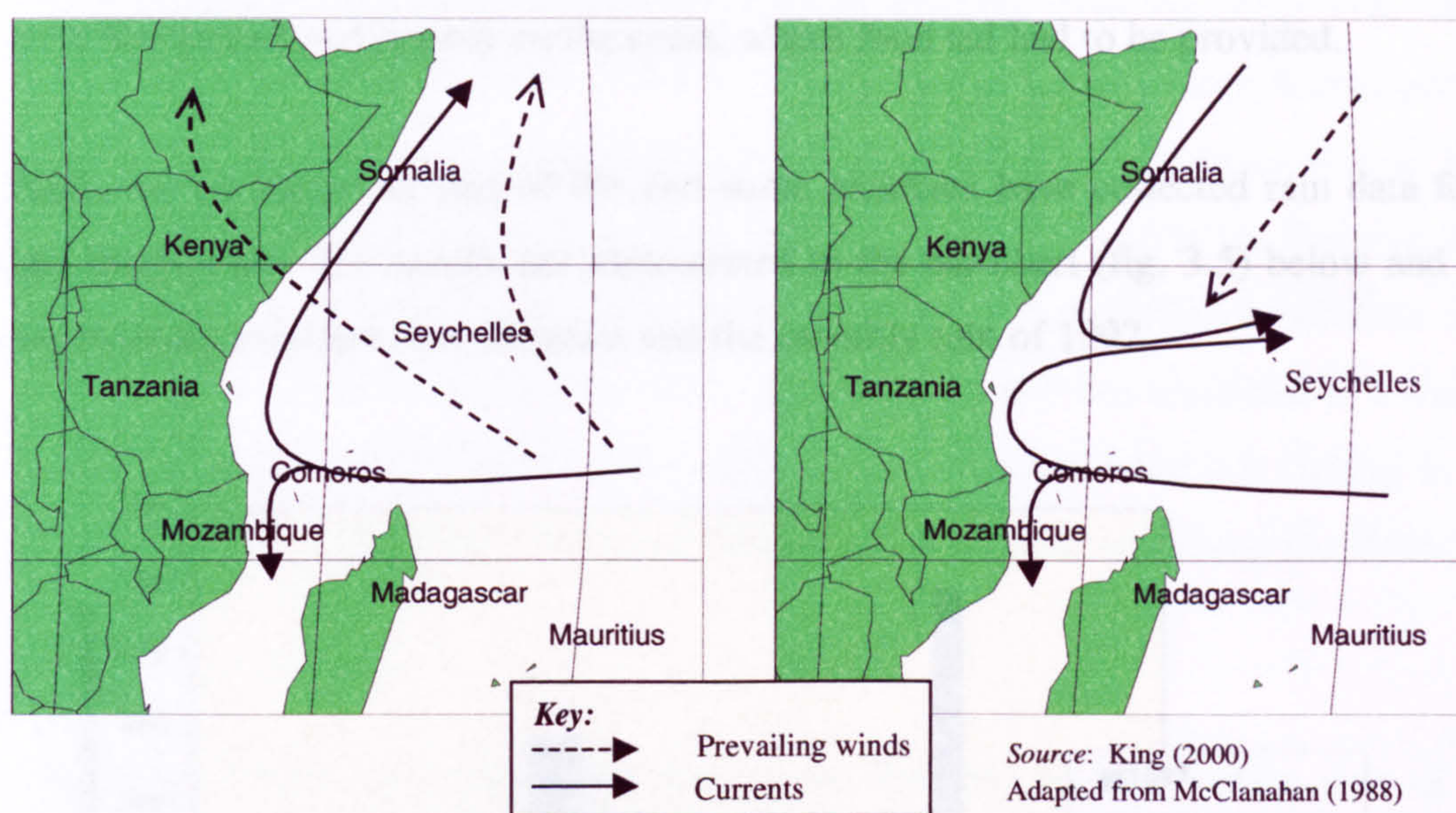
The Kenyan coast is subject to the Intertropical Convergence Zone migration which conditions the area's dual seasonal pattern (McClanahan, 1988). Northeasterly winds result in the North East (NE) monsoon (*Kaskazi*) and the Southeasterly winds result in the South East (SE) monsoon (*Kusi*). Thus the coastal climate is characterised by one marked long rainy season (from March to October) with strong winds, and a long dry season from October to March, with some short rains around November (Martin and Martin, 1983, McClanahan, 1988). This climatic pattern affects the oceanographic parameters and coastal activities.

The East African coast is part of the Indian Ocean's clockwise circulation. The South Equatorial Current which traverses the Indian Ocean meets the coast at the level of Tanzania. During the SE monsoon the current continues North along Kenya and leaves the continent at the level of Somalia (see fig. 3.4a). During the NE monsoon, the winds slow down the current and reverse it which creates the Somalia Counter current (McClanahan, 1988; see fig. 3.4b). The East African coast is a downwelling area all year around but this downwelling is stronger during the SE monsoon when the winds are greatest (Bell, 1972). Moreover, the waters of Southern Kenya (study area) and Tanzania are characterised by low nutrient contents (McClanahan, 1988). These seasonal patterns affect the fishing activities.



a) SE monsoon

b) NE monsoon



**Figure 3.4: Seasonality of wind and current patterns in East Africa**

The low productivity waters associated with the downwelling do not favour fisheries resources but the catch significantly reduces during the SE monsoon, when the winds are strongest and the conditions are often too hard and dangerous for fishers to fish (McClanahan, 1988, Rubens, 1996, pers.obs.). Although the catch is likely to be affected by the variation in oceanographic parameters triggering fish migration (Williams and Newell, 1957) or decreased density because of a deeper thermocline in the SE monsoon (McClanahan, 1988), there is little evidence of it due to the lack of data (McClanahan, 1988). The seasonal decrease of catch is, up to now, mainly correlated with the decrease in effort during the rainy season.

### 3.2.2.3 The rains and terrestrial activities

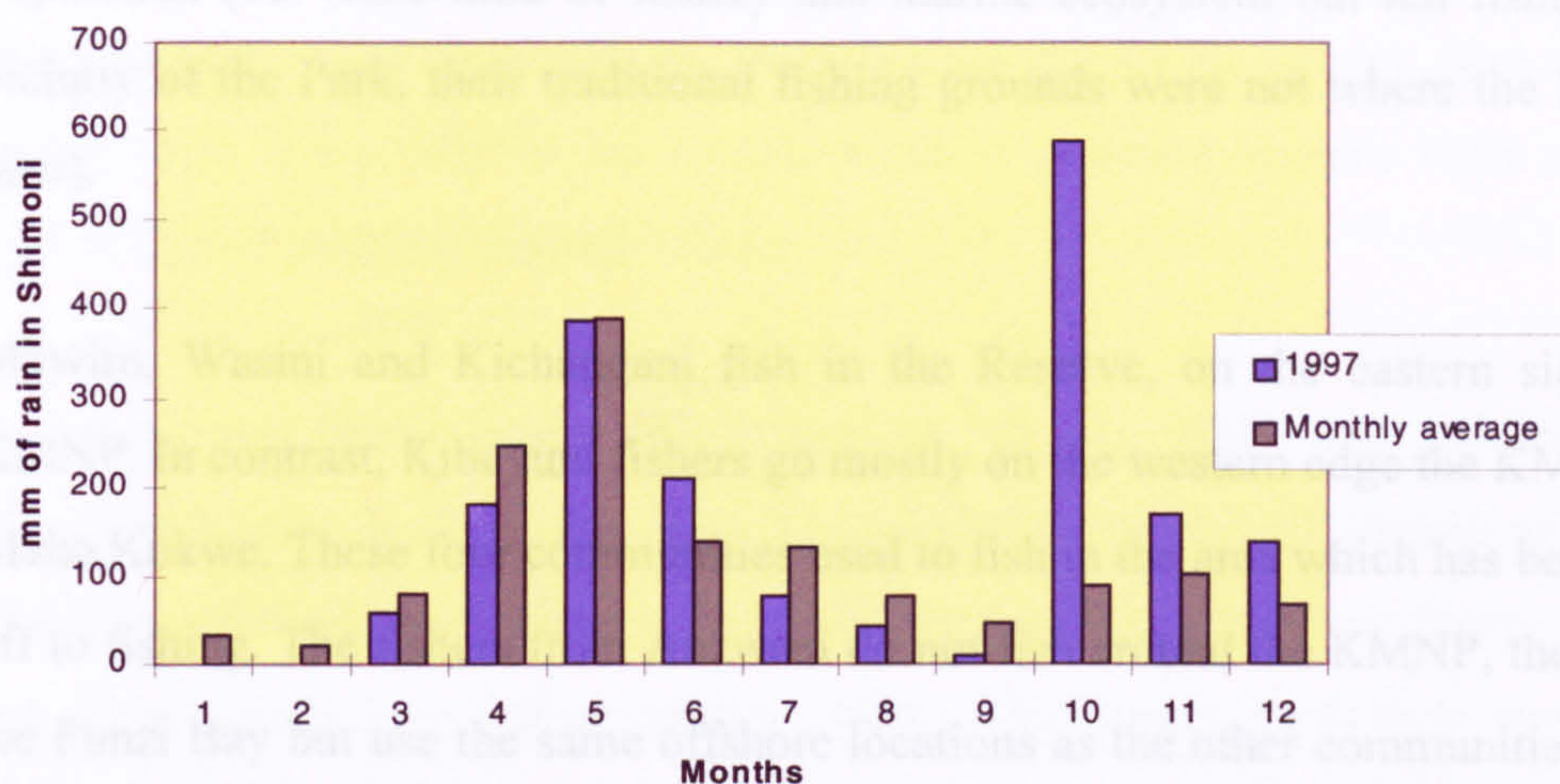
The yearly rainfall in the study area is 970 to 1400 mm/year (GK, 1991). The rains condition the agricultural activities on the coast as there are no irrigation systems in place. Their timing and quantity determine the success or failure of the crops. During the years' fieldwork in 1996/1997, the coast was hit by El Niño which led to



### 3.2.3.1 The choice

extraordinary rain patterns and eventually to the flooding and destruction of crops all over Kenya and particularly on the coast, where food aid had to be provided.

Rains are an important part of life and some residents have collected rain data for the last thirty years. The results are summarised in the bar chart (fig. 3.5) below and show the monthly averages over 30 years and the monthly rain of 1997.



**Figure 3.5: Monthly averages (1967 to 1997) of rainfall in Shimoni compared to the rainfall of the year 1997** (Source: Shimoni residents)

In the study sites, the main activities are fishing agriculture and tourism all depending on the natural resources. These activities are subject to the seasonal climatic patterns of the East African coast

### 3.2.3.2 Diversity of people and traditional activities

Three ethnic groups are present in the study area. They used to be distinct but by

### 3.2.3 Five communities around the KMNP

In order to establish a link between the KMNP and the state of the surrounding fishery, five main fishing communities out of seven were chosen. They were selected after reconnaissance tours and discussions with fishers.



### **3.2.3.1 The choice**

The criteria of selection were that villages were identifiable, the location of their fishing grounds and their accessibility (walking distance from Shimon). Four of the villages (Wasini village and Mkwiro on Wasini island, Kibuyuni and Kichangani on the main land, see fig. 3.3) were chosen on the basis that they were accessible, their main fishing grounds were located near the Park (KMNP) and/or the Reserve, they were more or less closely associated with the KMNP (i.e. at different distances from the KMNP). The fifth village (Anzwani, on the main land) was identified as a control population (i.e. same kind of fishery and marine ecosystem but not fishing in the vicinity of the Park, their traditional fishing grounds were not where the KMNP is now).

Mkwiro, Wasini and Kichangani fish in the Reserve, on the eastern side of the KMNP. In contrast, Kibuyuni fishers go mostly on the western edge the KMNP, near Mako Kokwe. These four communities used to fish in the area which has been closed off to fishing. The fishers from Anzwani do not fish around the KMNP, they exploit the Funzi Bay but use the same offshore locations as the other communities (see fig 3.3).

Shimon was not selected. Even though it is the most obvious and large village, its boundaries are very fuzzy thus a lot of uncertainty would have surrounded the selection of representative households.

### **3.2.3.2 Diversity of people and traditional activities**

Three ethnic groups are present in the study area. They used to be distinct but by mixing with the dominating Digo group, they now tend to be more and more assimilated. However, identities are still alive.

The inhabitants of Kibuyuni, Kichangani and Anzwani are predominantly Digo. The Digo are Bantu people and belong to the Mijikenda (80% of the coastal population) (GK, 1994). These groups are thought to originate from the Zambezi Valley and it is

believed that they have migrated up the coast from until they were stopped by the *Galla* people in Somalia. They then turned back and settled in *Kayas*<sup>9</sup> along the Kenyan coast from the 15<sup>th</sup> to the 17th century (Spear, 1978). At that time the Digo entertained a close relationship with the urban Swahili already established in the coastal towns and provided them with food stuff and fish. The Mijikenda's traditional activity was slash and burn agriculture but at the contact of the Swahili they adopted a cultural model where agricultural work was disdained (Gerlach, 1964, McKay, 1975, Spear, 1978). The moment the Digos started to fish is unclear, but it is likely they developed fishing skills when trading with the Swahili. Although the Digos had privileged links with the Swahili since the XVIth century, they massively converted to Islam only in the 1930's which is believed to have been a reaction against British power (Sperling, 1988).

The two other ethnic groups; the Shirazi in Mkwiro, Bodo and Shirazi and the Vumba in Wasini, are less numerous. The people of Mkwiro still identify themselves as Shirazi (fishers, pers.comm.). They believe they originate from Shiraz in Persia and deny coming from Africa (McKay, 1975). They rarely speak their own Swahili dialect; the Kifundi. Shirazi people are stricter Muslims than the Digos. Their main activities were mangrove cutting, fishing and they also used to have small coconut plantations and fruit gardens. However, the Shirazi identity has nearly disappeared due to the intense mixing with the Digos (McKay, 1975, fishers, pers. comm.).

In contrast, the Vumba, still constitute a very distinct group even in appearance (Hollis, 1900, closer to Arabs than to Bantu). They have their own Vumba language but Swahili is more widely spoken as well as Arabic which men learn at the Koranic schools. They still identify themselves as Vumba and do not consider themselves nor Swahili or Bantu or Arabic (slightly derogatory) when asked, even though they are strict Muslims (Hollis, 1900, McKay, 1975). The Vumba are mainly found in Wasini and Vanga (coastal town at the Tanzanian border) to which they are tied historically (Hollis, 1900) and have maintained strong links until today. They are urban people

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<sup>9</sup> Kayas were fortified villages. They were abandoned in the 17th centuries. Their places are now considered sacred by the local people and constitute pilgrimage locations.



and were traditionally fishers and traders/smugglers (Hollis, 1900). Although smuggling is much less important today than a decade or two ago, it still continues on a small scale. They had slaves usually working in their plantations on the mainland. Otherwise they bought foodstuff from other tribes (McKay, 1975).

All three groups are Muslims and have strong links with the Islamic world through the numerous Koranic schools (pers.obs.) and large aid programs from Islamic countries (i.e. Aga Khan Hospitals, dispensaries...).

### **3.2.3.3 The main activities of the villages**

On the mainland, subsistence agriculture is strongly present, particularly in Kibuyuni. The main crops are maize, rice and pulses. In Kibuyuni households practise agriculture on a larger scale than the other communities as it is located on a raised reef with fertile loamy soil (GK, 1991). On the island, however, there is no fresh water and poor quality soil; agriculture is hence nearly non existent.

Fishing is still traditional and practised on a small scale, although very few fishers have engine powered boats. The majority of boats are wooden dug out canoes which have been used for centuries. These canoes are sailed or poled. *Ngalawa* (outriggered canoes) are also used but on a smaller scale. They are sailed wooden canoes made on a Polynesian design and are believed to be the result of the encounter of Madagascans (Polynesian origin) with the migrating Bantu people (Spear, 1978). By adopting this design, the Bantu improved the stability of their dug out canoes and were able to go further offshore, developing their marine fishing skills (Spear, 1978). In a much smaller proportion, larger traditional sailing boats or (dhows), with lateen rigs are present. In Wasini, a few dhows are fitted with an engine. Mkwiro and Kibuyuni benefitted from the USAID/KWS aid project and received in 1995 each two dhows with engines and nets.

The fishing gear is predominantly traditional and includes handmade traps, spears and handlines. In addition, during the long rains (*Kusi*), fishers from Kibuyuni,



Kichangani and Anzwani set up numerous tidal weirs. Gill nets are also widely spread. Although spearguns are increasingly used in other areas (i.e. in Diani) very few used them in the studied villages. Seine net fishing, mainly practised by migrant Tanzanian groups, have been banned on the south coast of Kenya. Although forbidden, these nets can still be seen in operation (pers.obs.)

Offshore fishing spots, located in deeper waters were considered the best fishing areas. However, these offshore locations are two or three hours sailing away and can only be reached during the dry seasons when the winds are in the right directions. Thus fishing occurs in shallow waters, nearshore or on patchy reefs.

Coral reef demersal species are the main target of traps, tidal weirs, spear guns, spears and handlines. Handlines are also used to catch larger pelagic species. Set nets and lines can be used to fish further offshore for species such as marlin and sailfish. Spears usually target octopus which are often collected by women on reef flats. Crabs, prawns and lobster used to be abundant in the area (Glaesel, 1997) but only prawns remain caught on a regular basis. Finally, sea cucumbers are also collected, boiled, dried and sold in the main market of Mombasa for a relatively high value. Their destination is the Chinese market. Further details on the fishing gear and the seafood market are given in Chapter 5.

Although catches can be low and fishing is practised on a very small scale; it is the main commercial activity of most of the studied villages and it represents, for a lot of families, the only source of monetary income.

Other activities are carried out in the studied communities. For example, trading has always been important in Wasini (McKay, 1975) and still is. Tourism based on sport fishing and on the KMNP has steadily increased in the area. More and more young people are employed by tour operators or take people snorkelling to the KNMP themselves. This is particularly true for Wasini where fishing has slowly been replaced by tourism related activities (i.e employment in restaurants, taking tourists to the park).



#### **3.2.3.4 A summary of the village characteristics**

As stated before, livelihoods in the study sites depended on the ecosystem. The main activities in the selected villages are fishing, tourism related employment and agriculture.

Extensive reef flats surround Wasini Island, large mangrove forests are found on its seaward side and small sandy beaches on its landward side. Both Wasini (located on the west side) and Mkwiro (on the east side) of the island face the mainland. They are roughly 3 km apart (in a straight line). The other three villages are located on the mainland at different distances from Shimoni, Kichangani (or Changalaweni) about 1 km west of Shimoni, Kibuyuni 7 km in the same direction and Anzwani about 3.5 km North of the port. All the villages used to be located on the seashore but the community of Anzwani progressively moved towards the main road. Thus, the shore is about 2 km away from the centre of Anzwani village. The mainland's coastline, as the island's, is characterised by stretches of mangroves and large reef flats.

The selected communities were similar in size (roughly between 500 and 800 inhabitants<sup>10</sup>) except for Kichangani, which was much smaller with about 150 people. A summary of the main characteristics of the studied communities is presented in table 3.1.

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<sup>10</sup> The number of inhabitants of the various villages were estimated on the basis of the list of households established at the beginning of the fieldwork during village meetings.



**Table 3.1: Main characteristics of the studied villages**

Villages	Size	Ethnic Groups	Location	Fishing grounds	Activities
Wasini	500-800	Vumba	West side of island	Reserve (East KMNP)	Tourism- Trading
Mkwiro	500-800	Digo/Shirazi	East side of Island	Reserve (East KMNP)	Fishing- Tourism
Kichangani	100-200	Digo	1 km west of Shimoni	Reserve (East KMNP)	Fishing-Farming- Tourism
Kibuyuni	700-900	Digo	7 km west of Shimoni	Reserve + West KMNP	Fishing- Farming
Anzwani	500-800	Digo	3.5 km north of Shimoni	Funzi Bay	Fishing- Farming

**3.2.4 Conclusion**

The features and history of the coast have contributed to the make up of a specific socio-cultural organisation and probably a particular economic development. The study sites reflect this specificity. Although the selected sites seemed to be homogenous, a closer look enabled to discern some differences. Acknowledging the variety of the people, their historical and cultural baggage, could help us understand their resource use patterns as well as the differences in the communities’ adaptation to an evolving economic context. These factors need to be borne in mind when investigating and interpreting the links between the socio-economic situation of the communities and the presence of the KNMP.



## 4 Background information on the research methods

### 4.1 CONCEPTS

In this research, participatory methods were used in order to associate the explanatory powers and richness of the local people's knowledge to the quantitative information collected. The following sections define the concepts that were used in the study, present the methodological framework on which the fieldwork was based and introduce the informants. Techniques and analytical tools will be described in the relevant sections.

#### 4.1.1 Units of analysis

##### 4.1.1.1 Communities

A community is often defined as: “*a group of people who consciously share a functional or moral link such as kinship, occupation, place of residence, religion or values*” (Renard, 1991 cited in White *et al.*, 1994: 15). The link I used to identify the communities of the study area was the village chairman.

Village chairmen are administrative representatives elected at the community level (usually by the elders). They are administratively below the Chiefs of the sub-location and location who are appointed by the government. Although a legacy of the colonial regime taken on by the current government, the village chairman is a well-respected and recognised function by the villagers. In the study area, administrative boundaries of the villages did not always match the ones defined by the villagers. This made it difficult to identify communities. After several discussions, it was decided that the boundaries of the ‘community’ or ‘village’ (used indifferently)



would correspond to the village chairmen's jurisdictions. Hence, for the purpose of this study, a community was understood as 'a group of people consciously sharing a village chairman'.

Thus Kibuyuni also included Kijiweni, Utsambo, Guraya and Mwagogo (small hamlets surrounding Kibuyuni) which inhabitants considered Kibuyuni's village chairman as theirs as well. On the other hand, although the villages of Anzwani and Kichangani were administratively assimilated to Shimoni and recognised Shimoni's village chairman as having a role in their communities at a higher level, they had their own designated village chairmen and were hence considered as separate communities.

#### **4.1.1.2 Households**

The unit of analysis chosen to investigate the communities' food security status was the 'household'. It is an accessible and recognisable research unit, and is assumed to be the level at which resources are pooled and decisions are taken about consumption, production and investment (Corbett, 1988). However, although the household is used extensively, particularly in food security analysis, the concept is rarely defined or described (Corbett, 1988).

The first stage of the fieldwork involved making a household census in each selected village in order to build sampling frames. It was hence essential that the villagers and the researcher had a common understanding of what constituted a 'household'.

A household is often referred to as the people living in one house in a collective manner (Collins, 1994) but it is not a fixed entity, its composition varies in space and time (Caldwell *et al.*, 1986). For example in western countries households are commonly composed of the nuclear family but in Sub-Saharan Africa, households often comprise extended family (Kabeer, 1991). Furthermore, the household is a dynamic unit and, reducing its size by decreasing the number of consumers (e.g.



migration of some of the members, put the children in care, betrothing daughters) is often used as a strategy to cope in times of crisis (i.e. drought) (Devereux, 1993).

This study focuses on the socio-economic characteristics of households and their evolution in time. With the villagers, it was decided that an appropriate definition could be the people who live under the **same roof and share food and money**. In Swahili, it was referred to as '*watu wanakula kwa moja na wanaweka pesa kwa moja*'. This was similar to the sociological "common-cooking pot definition" of the household: "*a group of persons sharing a home or living space, who aggregate, and share their incomes, as evidenced by the fact that they regularly take meals together.*" (Marshall, 1994:121). It enabled me to identify and deal with different types of households:

- If different nuclear families lived under the same roof, ate 'in the same pot' and shared the money, they were being considered as one household (occurred but rarely).
- If different families lived under the same roof but ate separately and did not share money, they were considered as separate households,
- If people were not living under the same roof and people from one house supported financially people in another house (e.g. son supporting his parents and/or siblings) they were considered as separate households as they were not under the same roof, finances were separate and livelihoods were often not the same. (Often the supported unit had small sources of income such as small informal activities).

The 'household' is widely used as a unit of analysis but more and more the underlying assumption of its homogeneity is questioned (Maxwell and Frankenberger, 1992). Studies show the importance of acknowledging intra-household differences in research and development project design (Kabeer, 1991, Maxwell and Frankenberger, 1992). Within the household, age or/and gender can determine different access to resources (i.e. to food), division of tasks, difference in decision-making ability (Kabeer, 1991, Slocum *et al.*, 1995). This intra-household

heterogeneity can have impacts on households' vulnerability to crises. For example, Kabeer (1996) showed that children are better off if mothers are in control of the income rather than fathers, as their priorities can differ. At the same time, women have more difficulty finding employment and are more likely to lose it in times of crisis thereby increasing the strength and duration of the crisis (Gittinger *et al.*, 1990, Maxwell and Frankenberger, 1992).

Thus, using 'household' as a unit of analysis should not hide the fact that it cannot always be considered as a homogenous entity. Often, household members do not have equivalent access to food or monetary resources and do not have the same employment opportunities. These differences have to be borne in mind when analysing findings.

#### **4.1.2 Introduction to participatory methods**

Participatory methods are 'people-centred' approaches (Thomas-Slayter, 1995), they are interactive, iterative and open-ended (Guba and Lincoln, 1985). They allow local people to establish their own analytical framework and to challenge top-down development strategies (Mukherjee, 1995). By recognising that local people have knowledge and opinions, these methods were designed to enable people to express their needs and concerns (Chambers, 1992, Thomas-Slayter, 1995, Norton, 1998).

These approaches appeared in the 1970's at a time when the balance sheet of 30 years of development did not seem to have had the expected results (Nelson and Wright, 1995, Thomas-Slayter, 1995). It was realised that top-down, industrialisation based development focusing on infrastructure and transfer of technology was often maladapted to local realities and to the cultures on which they were imposed (Nelson and Wright, 1995, Thomas-Slayter, 1995). Furthermore, 'structural adjustment' policies promoted by the international agencies' often resulted in the poor becoming poorer (Nelson and Wright, 1995). Questioning development policies invariably led



to reconsideration of conventional research on which the decisions were based. For Chambers (1992), participatory methods emerged to replace what he refers to as 'rural tourism' where researchers imposed their worldview to respondents through questionnaire surveys, treating respondents as passive receptors and mostly getting distorted results.

It was also realised that, in order for development to be sustainable, projects had to target the right people (e.g. include women) and had to be owned by the local communities (Thomas-Slayter, 1995, Chambers, 1997, Mehta, 1997, Leach *et al.*, 1998). For that, communities and particular groups within these communities need to be empowered (Thomas-Slayter, 1995, Nelson and Wright, 1995, Chambers, 1997, Borrini-Feyerabend, 1998).

More and more research in development has adopted participatory methods such as Rapid Rural Appraisal (RRA) inspired by Freire's (1968) ideas on oppressed groups (Thomas-Slayter, 1995, Nelson and Wright, 1995, Chambers, 1998). These approaches emphasise the benefits of informal relationships, open-ended questions and visual tools (Chambers, 1992, 1998, Norton, 1998). They target specific groups (e.g. ethnic or religious minorities, the poor, women) (Thomas-Slayter, 1995) and also provide quicker and more cost effective methods (Chambers, 1992).

The methods developed between 1970s and 1980s resulted in increased involvement and recognition of people's abilities but they were still extractive research methods (Chambers, 1992, Thomas-Slayter, 1995). Researchers extracted information and had total control over their results. This could not lead to the empowerment of the communities or of groups within these local communities (Chambers, 1992, Thomas-Slayter, 1995). Thus, in the 1990s, a new wave of approaches appeared including Participatory Rural Appraisal (PRA) which promoted people's empowerment, particularly through the sharing and change in the ownership of the research. For example, PRA which is an extension of RRA, promotes social techniques (e.g. group activities), transparency of the research, self-awareness and a trial and error process where the researcher becomes a facilitator and listener

(Chambers, 1992). In PRA, the technology is shared rather than transferred and the communities own the research by carrying it out (Chambers, 1992, 1997, 1998, Norton, 1998).

Most of participatory approaches were designed and developed in relation to agriculture (Pido *et al.*, 1998). Reasons might be found in the fact that agriculture has been at the centre of development policies. For example, drought prone areas that have suffered chronic famines are the areas on which development agencies concentrated their efforts. However, participatory research has been adapted to the study of coastal environments and has been used in South East Asia since the end of the 1980s (Fox, 1986, Howes, 1987, McCracken, 1990, Pido *et al.*, 1990, Townsley, 1993, Lamug, 1994, Pido, 1995). More structured participatory methodological frameworks have also been designed in order to study fisheries and related institutions such as the Rapid Appraisal of Coastal Environments (RACE) (Pido and Chua, 1992). Recently the Rapid Appraisal of Fisheries Management Systems (Pido *et al.*, 1997) was developed to study institutional and traditional management systems, and social organisation in relation to artisanal and coral reef fisheries (Pido *et al.*, 1997).

#### **4.1.3 Tools, sampling and validity in participatory methods**

In participatory methods, interviews are mainly semi-structured or informal and questions are open-ended so as not to restrict the respondents (Chambers, 1992). They enable the researcher to have a better understanding of the context in which the informants interact (Bernard, 1995). Most of the techniques are visual so that participants can share their knowledge and get actively involved. These techniques include mapping, card sorting, drawing of matrices, venn diagrams. Ranking, scoring, and comparing replace measuring (Chambers, 1992, 1998, Holland and Blackburn, 1998). Furthermore, in PRA, group interviews (i.e. homogenous groups such as groups of the poorer women or a minority) are preferred as they are thought



to enable participants who usually would not express themselves to do so in a more relaxed way. Finally, the results are presented on site, by the community members themselves who then own the research (Chambers, 1992, Norton, 1998).

In this research open-ended questions, informal interviews, semi-structured interviews and focus groups were the main tools used to gather information.

Participatory methods acknowledge that communities are heterogeneous, they focus on and seek the differences (Welbourn, 1991). In order to understand the complexities and the diversity within communities, purposive sampling is used (Dunn and McMillan, 1991). In purposive sampling researchers know the purpose for which they want informants. They go and find them but there is no sample framework determining how many informants are needed. The researchers learn in the field, which units of analysis and informants are needed for the purpose of the research (Bernard, 1995). For example, to study the seafood market in Diani, it was necessary to interview fishers, fish traders, intermediaries, fish processor and distributors but no sampling frame was needed to get an overall idea of how the market functioned, the type of products sold, the prices at the producers' end and at the distributors end etc. (Malleret-King, 1996). The use of non random sampling such as purposive sampling had led to criticism from advocates of conventional research (Holland and Blackburn, 1998).

However it is argued that participatory methods were developed as an alternative to conventional approaches and questioned their trustworthiness (Gill, 1991). The traditional criteria for testing the robustness of positivist research results are internal and external validity, reliability and objectivity (Bernard, 1995, IDS, 1998) but for Pretty (1993) results of participatory methods should be tested according to alternative criteria. These could be credibility (for internal validity), transferability (external validity), dependability (reliability) and confirmability (objectivity) (Pretty, 1993).

Checking the validity of the results is an important part of participatory approaches and techniques such as cross checking, triangulation, overlapping methods and replication are used (Chambers, 1992, IDS, 1998). Researchers and development agents are careful to document their activities and choices extensively as usually it is participatory methods which have to prove their utility to policy makers rather than the conventional methods (Shoonmaker Freudemberger cited in IDS, 1998: 173). During the fieldwork it was not rare to have the feeling that informants were not always telling the truth, or were telling what they thought I wanted to hear. However, it was often easy to cross check the information by repeating a question in a different way.

The credibility of participatory methods is increasingly accepted. It has been shown that a scoring exercise purposively sampled can be more statistically robust than a simple random sample, a mapping exercise represents 100% of the community, that monitoring through participatory methods are often both more cost effective and more popular (IDS, 1998).

Moreover, the comparison of results collected by well-conducted questionnaire surveys and by participatory techniques showed that the latter were “*more valid, less costly, more timely and more useful*” (Chambers, 1992:35). For example in a study about farmers concern and problems in the Philippines, the questionnaires survey identified the farmers’ main problems as being the loss of fertility of the soil (Bernadas, 1991 cited in Chambers, 1992). However, by using informal dialogue with farmers rather than asking predetermined questions (biased by researchers’ point of view) it was possible to realise that the most pressing problem of farmers was not the soil fertility but the long fallow due to the growth of a weed. The information was thus more useful as it permitted for research to be more focused and the results were more valid in the sense that they were closer to the reality of the farmers. Moreover, RRA or PRA surveys are relatively quicker than more conventional methods. For example, in Sierra Leone the results of a study using participatory methods after a questionnaire survey (278 questions) had been carried out in the same locations were presented less than a week after the last location was



surveyed, whereas it took another six months for the less valid results of the questionnaire survey to be available (Inglis, 1990, 1991 cited in Chambers 1992). Chambers (1992) recognises there are trade offs between rapidity and amount of information gathered but he argues that there is an optimal ignorance which has been taken on by other researchers (Haddad *et al.*, 1994).

The criteria of transferability is the most difficult to achieve as standardisation is contradictory to the participatory principles which emphasise diversity and relative values (Chambers, 1994a, b). Efforts are made to promote participatory methods' potential to provide quantifiable indicators (IDS, 1998). However, the strength of participatory approaches lie in "*their qualitative explanatory powers*" (IDS, 1998: 171) and it might be inappropriate to force these methods to fit the conventional positivist model (Shoonmaker Freudenberg, 1998). She argues that good participatory research requires time and a large amount of energy and enthusiasm, which cannot sustain large-scale replication. The aim is to understand the issues rather than extrapolate/aggregate/standardise. More and more researchers should be opened and flexible so as to choose a blend of 'most appropriate' approaches (IDS, 1998).

In this research, formal questionnaires (described in chapter 6) were also used to produce results that could be compared between villages and analysed quantitatively. However, the formal questionnaires were developed on information obtained through participatory methods. By developing the questions through a participatory process, site specific processes and behaviours were identified. Moreover, participatory tools were used as much as possible as they were often the quickest and most accurate tools to build up an overall picture of the communities. The qualitative information provided an invaluable in-depth knowledge and an understanding of the variability at the local level, while the quantitative methods allowed me to measure the spread of problems and compare situations. This reflected the complementarity of the qualitative and quantitative methods in the study of household food security (Maxwell and Frankenberger, 1992).

## **4.2 ACTORS AND DATA COLLECTION**

### **4.2.1 The research assistant: key to communication**

As previously experienced (Fortmann, 1995) the crucial element to the success of this fieldwork has been the presence of enthusiastic research assistants. To carry out interviews, I needed the help of translators when necessary but also of facilitators.

At first, a young nursery school teacher of Mkwiro was recommended, volunteered and was hired. She lived on the mainland even though she was teaching on Wasini Island. Unexpectedly, she was not very well accepted by the women of Mkwiro; she was not considered part of the community. I discovered later that she was not a Digo (the main tribe) but a Duruma<sup>11</sup>. As soon as the households' surveys started, tension showed and selected informants in Mkwiro were reluctant to speak to us. To tackle this problem we agreed to hire a second young woman from Mkwiro to help us. She was fluent in English, educated, and from the community. She also had helped a researcher the year before who had interviewed fishers and thus knew what type of work was required.

The first assistant did not enjoy the research and resigned. In view of the improvement due to the presence the assistant from Mkwiro, five other young women were hired to facilitate the research in the other villages. The research assistants were paid a fee per interview and were from the villages in which the interviews were carried out.

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<sup>11</sup> The Duruma are also part of the nine Mijikenda tribes. However, they are located further inland in Kwale District.



**Table 4.1 : The research assistants**

<b>Villages</b>	<b>Age</b>	<b>Education</b>	<b>English</b>	<b>Ethnic group</b>
<b>Wasini</b>	20	secondary	fluent	Vumba
<b>Kichangani</b>	25	primary	fluent	Digo
<b>Anzwani</b>	21	secondary	fluent	Digo
	25	secondary	fluent	Digo
<b>Mkwiro</b>	28	secondary	fluent	Digo
<b>Kibuyuni</b>	16	primary	low	Digo/Pemba

Having enthusiastic assistants from each village improved the accuracy of the interviews. They introduced me and the research to the households, which was essential, as people were often suspicious. As a result of their presence, informants were more open, more confident and less suspicious. The research assistants could translate when my Swahili failed and could confirm some of the information collected. They also came up with suggestions on how to approach reluctant people, the research became team work. The main difficulties occurred in Kibuyuni where informants did not speak fluent Swahili but spoke a Digo language and my assistant, could only translate from Swahili to Digo and vice et versa. Thus, the amount of information I could get in the village was limited even though my Swahili and Digo improved with time.

Except for the Kichangani assistant who was an exceptionally relaxed and good public orator, when focus groups involved fishers the research assistants did not participate actively. They were not comfortable taking part in discussions involving men, particularly their husbands or elders. However, in the groups, there always was a fisher who could speak Swahili and some English. If not, someone would join us and translate. In Kibuyuni, where English speakers were difficult to find, another researcher fluent in Swahili occasionally assisted me.

### 4.2.2 Informants and gender

As suggested by the previous section, gender was an important factor in the research design. Informants were selected according to the type of information needed. In the communities, as often found (Slocum *et al.*, 1995, Maxwell, 1996), a division of tasks according to gender could be observed.

Table 4.2: Gender and activities in the study sites

Activities	Women	Men
Housework	xx	o
Fishing:	x	xx
Octopus	x	xx
Other kinds	xx	o
Agriculture:	xx	x
Clearing	x	x
Sowing	xx	x
Weeding	xx	x
Tending	xx	x
Harvesting	xx	x
Tourism	x	xx
Cooking	xx	o
Waiting	o	xx
Office	o	xx
Labour	x	xx
Qualified	x	xx
Clerks	o	xx
Teacher primary	o	xx
Nursery school	xx	o

*x: occurs, xx: dominating gender, o: did not occur in the sites*

As shown in the above table, although some tasks were carried out both by men and women, most of the activities were gender specific with a male predominance for commercial/monetary (fishing, tourism) and qualified (e.g. office work, teaching) activities. Fishing was dominated by men but in Mkwiro some women also harvested octopus at low tide on the reef flats. On the other hand, housework and agricultural activities were dominated by women.

Division according to gender was reinforced by the fact that the main religion in the study sites was Islam. Traditionally, the Digo society was matriarchal but the massive conversion to Islam of the beginning of the century changed it into a



patriarchal society (Ng'weno, 1995). The resulting social organisation might explain why women were ill at ease with the researcher if there were men around. They were shy to express themselves and more so in the stricter village of Wasini. Thus, it was very important when interviewing women to make sure that no men appeared. Similarly, men were reluctant to speak about traditions and customs in front of women. For this reason, focus groups were never mixed and were organised in relatively out of the way areas.

The choice of informant reflected the division of tasks and the society's structure. Thus, when investigating the perceived relation between the state of the fishery and the presence of the Park, focus groups were exclusively composed of fishermen. On the other hand, women were the ones to prepare food. They knew the quantities prepared and the number of people who shared the food. They also knew when food had run out and what they did in such cases. Thus, when identifying household food coping strategies and their severity, women were the ones interviewed.

#### **4.2.3 Informants selection**

Most of the informants were selected in a purposive way but when appropriate, statistical sampling was used. For example, to constitute women's focus groups were used a simple random procedure as described by Bernard (1995) within each village (we needed about eight women per village). For the quantitative analysis based on household surveys, random sampling was also used (Bernard, 1995). At least 30% of the households, listed at the beginning of the fieldwork, within each village were randomly sampled. In contrast, to select the fishers who would participate to the focus groups, purposive sampling was used (on average 6 fishers per group in each village). This was necessary as fishers needed to have been in the area for a long time and to have been fishing for a long time (i.e. before the establishment of the Park) in order to be able to compare the situation before and after. Thus they needed to be middle aged or old (selection processes are detailed in the relevant chapters).

Although a random sample is appropriate in certain cases, its realisation depends on the availability and will of the informants. For the focus groups, reserve groups were selected randomly in case selected women were unavailable or refused to come. During the household surveys, in case someone was not prepared to answer the questions, the next household on the list was chosen making sure that the proportion of households depending on each activity was kept. Reluctant informants were approached several times and usually with the presence of the assistants they would accept. If the refusal was strong, they were left alone. To investigate the park and its contribution to the tourism activity in the area, the tour operators were all interviewed.

### **4.3 CONCLUSIONS**

Participatory techniques are more and more accepted as part of a panel of research methods. Staying for a year in the field allowed me to get an in depth knowledge of the issues in the area and to try a lot of different participatory methods.

Five months of fieldwork in the southern coast of Kenya on a previous occasion gave me a background understanding of the area and a basic knowledge of the language (Malleret-King, 1996). However, my Swahili skills were limited and sometimes constrained my ability to use participatory methods. Although I developed relaxed relations with the informants (particularly key informants), these were less casual when I was obliged to go through a translator.

The previous fieldwork also gave me an experience of the kind of problems which can be encountered in the field. However, I did not suspect the amount of energy and enthusiasm needed to spend such a long time in the field. The tolerance and patience of the informants were essential to this research but the energetic support of the research assistants were crucial to the completion of the fieldwork as well as to the understanding of such a complex culture.



I cannot claim to have used PRA, as the aim of the research was inherently extractive. However, participatory tools were used at all stages of the research. Furthermore, the knowledge that local people shared with me was used as baseline information for a project of the World Conservation Union (IUCN) in the area. It enabled me to go back to the studied communities with a project aiming to increase the Park's benefits to the surrounding communities.

The objective of this chapter was to introduce some of the concepts and methodological framework used all along this research. However, specific tools and methods of analysis are described fully in the chapters which refer to them.

## **5 The link between the state of the fishery and the presence of the Kisite Marine National Park**

One of the main arguments for establishing NTZs is that by protecting the spawning stock they could contribute to the replenishment of surrounding fisheries (see Chapter 2). However, one of the keys to the success of these NTZs is their rigorous enforcement (Lauck *et al.*, 1998, chapter 2).

The KMNP, as most of the MPAs up to now, was created for tourism and environmental conservation. It was established following a top down approach without any consultation with the stakeholders (White *et al.* 1994, White and Christie, 1995). The result was that the main perception of MPAs by the fishing communities was that they prevented access to traditional fishing grounds. This was unacceptable as to them: “ *the sea is God’s sea, it is the people’s sea; not the government’s* ” (Mkwiro focus group). The rejection of MPAs by local communities led to violence in Diani where the KWS buildings were burnt down (Malleret-King, 1996) and long protests in the area.

Conflicts between MPA authorities and local communities are now taken into account as they are believed to increase the cost of enforcement and hinder efficient management (Alder, 1996, Borrini-Feyerabend, 1998). Furthermore, it is believed that if local communities do not participate in the management of their resource and if they do not accept the MPA, enforcement is much harder, much more costly and often fails (White and Christie, 1995, Borrini-Feyerabend, 1998, Cocklin *et al.*, 1998, Salm and Ngoile, 1998).

The conflict between managers of MPAs and resource users is even stronger when marine resources are the main source of livelihood and when few good fishing grounds are available. This is the case for KMNP where the reef is patchy and the abundance of fish depends on the presence of a coral head (see chapter 8).



The aim of this chapter is to identify whether after 20 years of KMNP presence, any benefit to the state of the surrounding fishery could be detected. The first section shows the way in which the fishers and the authorities perceive the KMNP. The second section describes the fishery in order to understand the context of its evolution discussed in the third section perceived from the point of view of the catch statistics and of the fishers.

## **5.1 THE PERCEIVED EFFECTS OF THE KMNP**

The approach to MPA establishment has undergone changes in recent years particularly in Kenya where partnership with the communities has become a key objective (see part 3.2.1.2). As will be shown in this section, the efforts of KWS to communicate with and help the communities have had beneficial impacts on fishers' perception of the KMNP. However, the previous conflicts have not been forgotten.

The objectives of this section were to examine whether the stakeholders established any relationship between the fishery and the KMNP, the evolution of the attitudes of the fishers towards the KMNP and the reasons for this potential evolution.

### **5.1.1 State of the fish resources in and around the KMNP**

Increased biomass and improved recruitment are expected to result from NTZ establishment (Dugan and Davis, 1993, Roberts, 1997). Moreover, preserving an area from all kinds of extractive activities should also enable maintenance of genetic diversity of the stocks and diversity of habitat in the area (Roberts, 1997). These combined effects are thought to have a positive effect on the surrounding fisheries yields.

As mentioned in chapter 2, improvement of commercial fish species' abundance inside the MPA subsequent to its establishment has been shown in places such as Kenya, the Philippines, the Caribbean and New Caledonia (McClanahan and Shafir, 1990, Dugan and Davis, 1993, Roberts, 1995, Russ and Alcala, 1996a, 1996b, Watson, 1996, Wantiez *et al.*, 1997). Most of these studies were based on spatial comparisons (i.e. inside and outside the MPA) rather than on temporal ones (i.e. before and after the establishment of the MPAs). Background information is often lacking in order to be able to evaluate properly changes over time, particularly of fishing stocks, and show the evolutions of surrounding fishing yields (Munro, 1996). More data would be needed on the adjacent fisheries to give better indications of the real impact of MPAs.

Increased recruitment, larval dispersion inside and outside the NTZ, and the migration of adults outside the boundaries of the NTZ as the competition for food and shelter becomes stronger are the mechanisms expected to influence the surrounding fisheries replenishment (Chapter 2). The indirect effect of the protection of habitat essential to juveniles' survival should also contribute to the improvement of the fishery by leading to better recruitment (Watson, 1996). One of the objectives of Watson's (1996) research in Kisite and Mpunguti was to determine how the MNP had contributed to the management of Kenyan reef stocks. Her results are briefly summarised in the following paragraphs.

Except for groupers (*Serranidae*), commercial fish species were more abundant in unfished areas than in fished areas (i.e. the Reserve and outside) (Watson, 1996) which corroborated other findings around the world (Russ, 1991, Dugan and Davis, 1993, Russ and Alcala, 1990, 1996a, 1996b, Roberts, 1995, Roberts, 1997, Wantiez *et al.*, 1997). The abundance of fish in the KMNP and in the Reserve has improved since 1988 (Watson, 1996 in comparison to Samoilys, 1988). Although groupers' abundance in Kisite had increased in the previous ten years, they were less abundant than in Mpunguti Reserve where traditional fishing is allowed (Watson, 1996). This situation is attributed to the fact that due to their slow growth, groupers might not have had time yet to recover from overexploitation (Watson, 1996).



Catch composition can be a good indicator of the health of a fishery. By regularly checking catch and catching fish herself in the KMNP and the Reserve, Watson (1996) established that predatory fish species still dominated her catch. The main difference between the KMNP and outside was the size of these predators (i.e. predators were smaller in the fished areas). This would be expected as all fishing, by reducing life expectancy reduces the mean age of the fish population (Russ, 1991) thus leading to smaller individuals being found. It could also indicate that larger individuals have already been taken (Watson, 1996).

The main mechanism of replenishment of the fishery, as stated before, is the migration of larvae, gametes and larger fish individuals from inside the boundaries of the KMNP. A tag and release experiment was carried out on fish individuals inside the KMNP (Watson, 1996). However, no tagged individuals were caught outside the KMNP, which suggests little migration. A monetary incentive was given for fishers to report tagged individuals which was thought to be sufficient for them to really do it (Watson, 1996). Other explanations for the lack of recovered tagged individual were sought.

Potential explanations for the lack of migration were that the biomass in the MNP had not reached high enough levels of competition for food and shelter for fish to be obliged to migrate (Watson, 1996). However, in the Philippines Russ and Alcala (1996a) could only find evidence of predators' movement outside the MPA after 9 to 11 years. It is hence a process which can take a relatively long time and although the KMNP was established in 1978, enforcement was only considered obvious since 1989 when KWS took charge and after the Reserve had been created (Watson, 1996, see chapter 3). Another suggestion made was that natural barriers were acting as a deterrent for fish migration (Watson, 1996). Two kilometres of sand separated Kisite (the main reef in the KMNP) from the next reefs. Sand is not the natural habitat of the main commercial fish species so the large sandy patch might act as a hurdle (Watson, 1996). Moreover, according to Roberts and Polunin (1991) the greatest effect of migration on the fishery will be within one kilometre of the home reef.

A higher abundance of fish in the KMNP than in the fished areas and an improvement since 1988 of the abundance of commercial species in the KMNP had been detected. However, the study could not draw conclusions on whether the KMNP was acting as a source and replenishing the surrounding fishery. Information on the relationship between the surrounding fishery and the presence of the KMNP was thought to be achievable by interviewing some of the stakeholders.

### 5.1.2 Methods

To collect information on the perception of the KMNP by the surrounding fishing communities, focus groups were organised in each community (Slocum *et al.*, 1995). They were composed of 4 to 8 fishers of varied ages. Questions discussed in the groups were divided into themes, history (how the KMNP was introduced to them, how and why was it created), relations with KWS, advantages and drawbacks of the KMNP.

The KMNP Warden was also interviewed. A structured interview was used (Bernard, 1995). This method was chosen, as senior officials seemed to be more at ease with very precise questions. Moreover, the Warden had little time for informal discussion to occur. The structured character of the interview and the impossibility to meet with the Warden more than once meant that answers were constrained. However, it helped me understand better how KWS functioned on the ground. Questions about KWS structure and about the number of staff employed were left unanswered as they were thought to be confidential issues. Topics discussed with the Warden were the costs and income of the Shimoni base (see chapter 9), KWS relationship with the communities, KWS involvement in these communities.

Finally, some of the results of the household surveys analysed in chapters 7 to 9 were used to get information on the studied communities' economic structure.



### **5.1.3 Fishers' perception of the KMNP**

#### **5.1.3.1 Fishers' perception of the KMNP establishment process**

In terms of the historical background, all communities recalled the creation of the KMNP as others would recall a war. When the KMNP was imposed on them, the surrounding villages fought against it. Mkwiro was the most affected community as the first KMNP design (1978) included all of the community's traditional fishing grounds (i.e. Kisite, Mpunguti ya juu and Mpunguti ya chini) (see figures 3.4 and 5.5). Fishers made roadblocks, they went to see their MP and the National Parks headquarters (i.e. the authority in charge of the Parks and Reserves before the establishment of KWS). The battle went on for years but the communities finally won, the KMNP boundaries were shifted and Mpunguti was opened back up for fishing and transformed into a Reserve in 1988.

When asked why they thought the KMNP had been created and why it was located where it is, all the groups agreed on the fact that it had been created to attract tourists for the government to get money. For them, the area had been chosen because the English (i.e. colonial regime) were always interested in the nesting birds of the islands (e.g. Mpunguti, Kisite), and to increase patrols in the area as Tanzanians were coming in to dynamite the reef. These points suggest that the communities did not perceive the KMNP as for conservation or for them. Until the authorities opened Mpunguti to fishing in 1988, poaching was regular and there was no enforcement of the KMNP (Watson, 1996, Glaesel, 1997).

#### **5.1.3.2 Perceived advantages and drawbacks of the KMNP**

Although the studied communities were fiercely against the KMNP when it was first created, they seemed to have learnt to live with it. The groups said themselves that it took time to build up a relationship, that they had got used to the KMNP little by little and now could see benefits whereas previously they would only have seen the costs (loss of their rights, of their fishing grounds). However, the two steps that led

to the acceptance were the creation of Mpunguti as a Reserve and the aid, which came much later on.

**Table 5.1: Advantages and drawbacks of the KMNP mentioned by the fishers focus groups**

<b>Advantages</b>	<b>Times mentioned</b>
-Aid (boats, building of classrooms, wells..)	5
-Better control of fishing methods (dynamite and seine nets kept away )	4
-Employment (in tourism, in KWS)	3
-Rescue (if fishers in trouble the Parks sends a boat)	2
-Better fish	1
<b>Drawbacks</b>	
-Unjustified arrests (locking people up)	5
-Loss of best fishing grounds	3
-KMNP not well marked	1
-Impounding (often the gear is impounded because someone has done something wrong but it is not only one person's gear)	1
-Less fish (all gone into the KMNP)	1
- Authorities suspicious of good catch	1

As illustrated in table 5.1, the main perceived benefit of the KMNP was the aid and help associated with it. The most successful project in terms of acceptance of the KMNP by the local people has been the gift of six boats with engines and gear to three villages (Shimoni, Mkwiro and Kibuyuni) in 1995. But these came more than seventeen years after the creation of the KMNP.

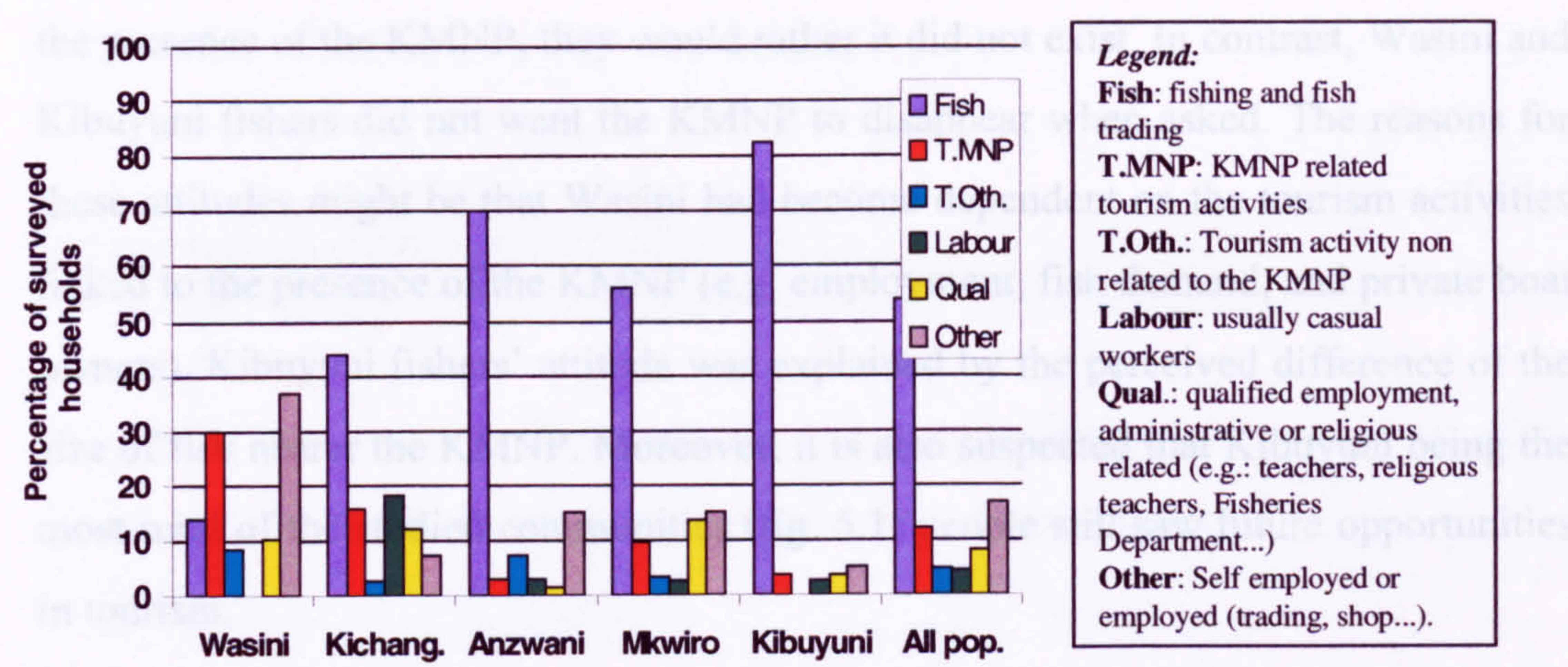
The second perceived benefit was the improved control of fishing methods which fishers believe to have reduced the destruction in the area. It is interesting to know that the first ban of the *Wapemba* (Tanzanians from the island of Pemba) seine netters came from a unilateral action of Mkwiro ten years ago, which was later supported by the administration. Thus, in Mkwiro the fishers focus group saw a direct link between the ban of seine nets and the fact that children could get fish again inshore after school. They saw the better control of fishing methods as a direct



communities often mentioned their reluctance to go near the KMNP, as they were  
afraid of being arrested. This might explain why they did not see the difference

consequence of their actions. In contrast, the other communities saw the control of  
destructive methods as a benefit from the KMNP.

Thirdly, employment was mentioned. This is mainly employment associated with  
tourism linked to the KMNP. Tourism seems to be slowly integrated in the  
communities' economy. Only Wasini has a high percentage (30%) of surveyed  
households depending at least partly on tourism (linked to the Park). In other  
communities such as Mkwiro or Shimoni this activity is growing (fig. 5.1).



**Figure 5.1: Economic structure of the studied communities** (source: household surveys)

Rescue was mentioned twice as an advantage, but strangely, when KWS rangers were interviewed they said they did not provide rescue, or had not had the opportunity to provide such a service. Several of the tour operators however have already helped fishers who had capsized (tour operators, pers. comm.) which might have been associated with the KMNP by the fishers.

Kibuyuni with 82.6% of households depending at least partly on fishing (see fig. 5.1), was the only group to mention better fish, which they felt was due to the presence of the KMNP. When asked, this group could see the difference between the fish caught in the near vicinity of the KMNP and the fish caught further away. Other



communities often mentioned their reluctance to go near the KMNP, as they were frightened of being arrested. This might explain why they did not see the difference in the fish near the KMNP (further analysis on the importance of the distance from the KMNP for the catch is done in chapter 7).

Overall in recent years the communities have grown used to the KMNP and have started to see it as a benefit through aid. However, there is still some opposition to it. For example, communities who have not received as much aid as others (i.e. Kichangani), still see the loss of fishing grounds as the main effect of the KMNP. Moreover, although Mkwiro fishers were resigned and sometimes positive towards the presence of the KMNP, they would rather it did not exist. In contrast, Wasini and Kibuyuni fishers did not want the KMNP to disappear when asked. The reasons for these attitudes might be that Wasini had become dependent on the tourism activities linked to the presence of the KMNP (e.g. employment, fish demand, and private boat owners). Kibuyuni fishers' attitude was explained by the perceived difference of the size of fish nearer the KMNP. Moreover, it is also suspected that Kibuyuni being the most rural of the studied communities (fig. 5.1) people still saw future opportunities in tourism.

The varied reactions of the groups confirmed previous results (Glaesel, 1997) which showed that even though the aid given by KWS and the change in atmosphere after Mpunguti was transformed into a Reserve, fishers were still discontented (e.g. in Mkwiro). One of the main points which was mentioned indirectly in the focus groups and developed by Glaesel (1997) was the bitterness of fishers about the fact that they could not go through the KMNP to get to their fishing grounds. The right of passage had been abused and was now forbidden (Glaesel, 1997). For some communities, this imposed added time (see fig 5.5) for some of the fishers to reach their fishing location (Glaesel, 1997).

Up to now, the main incentive for communities to accept the park has been aid. The degree of resignation, tolerance or acceptance of the KMNP by the surrounding communities varied with the amount of aid received. It is important to understand



these variables, as the communities are very different from each other. Their attitude to the KMNP varies and they have different economic structures.

The role of the KMNP in the replenishment of the surrounding fishery could not be identified by the study carried out by Watson (1996) although changes within the KMNP in the last 10 years were detected. Furthermore, group interviews showed that the KMNP was still a conflictual entity for most of the surrounding communities. A perceived relationship between the KMNP and the fishery only emerged in the Kibuyuni focus group. In order to analyse further the link between the fishery and the presence of the KMNP, the fishery and its evolution of the fishery were studied.

## **5.2 THE FISHERY**

The aim of this section is to describe the fishery to understand the constraints of the fishers and the context in which the fishing activity is carried out.

### **5.2.1 Method**

To discuss the fishery, focus groups (Slocum *et al.*, 1995), were organised in each village and were composed of 5 to 10 fishers. Middle aged to old participants were selected in order for them to be able to discuss the evolution of the fishery in the last 20 years at least. These groups allowed an in depth investigation of the characteristics and evolution of the fishery in a relatively small amount of time to be carried out. The themes discussed during the sessions were the description of the fishery (including gear, number of boats, fishers, seasonality, mapping of the fishing grounds), the traditional and current management of the fishery and the perceived changes in the state of the fishery in the last 20 years.

Results of the household surveys presented in chapters 6 to 9 provided detailed information on the importance of fishing activities for the communities and on the structure of the fishery.

Finally, in order to investigate another point of view and as an opportunity to cross check the information gathered through the group interviews, an old fishmonger who had been a fisher and the chief of the Shimoni fishers' cooperative was selected. He was interviewed in a semi-structured way (Bernard, 1995); a list of themes previously determined was discussed and questions were open-ended. The informal atmosphere of the interview enabled us to discuss a wide spectrum of issues. However, the aim was to examine the evolution of the catch, of the fish prices and of the fishing effort. The results of this interview added valuable information, and provided an insight into the perception of the fishery from the other end of the spectrum of the fishing activity (commercialisation and distribution of marine products).

## **5.2.2 The fishery as presented by the fishers**

Fishing in the studied villages was still artisanal defined as: *“carried out by small-scale fishing units often consisting of kin groups using small, occasionally powered boats or none at all. ...Investment levels are relatively low...Catch most often does not enter larger markets, but is sold at dispersed points of landing. And part or all the catch is operator or family consumed”* (Smith, 1979:3).

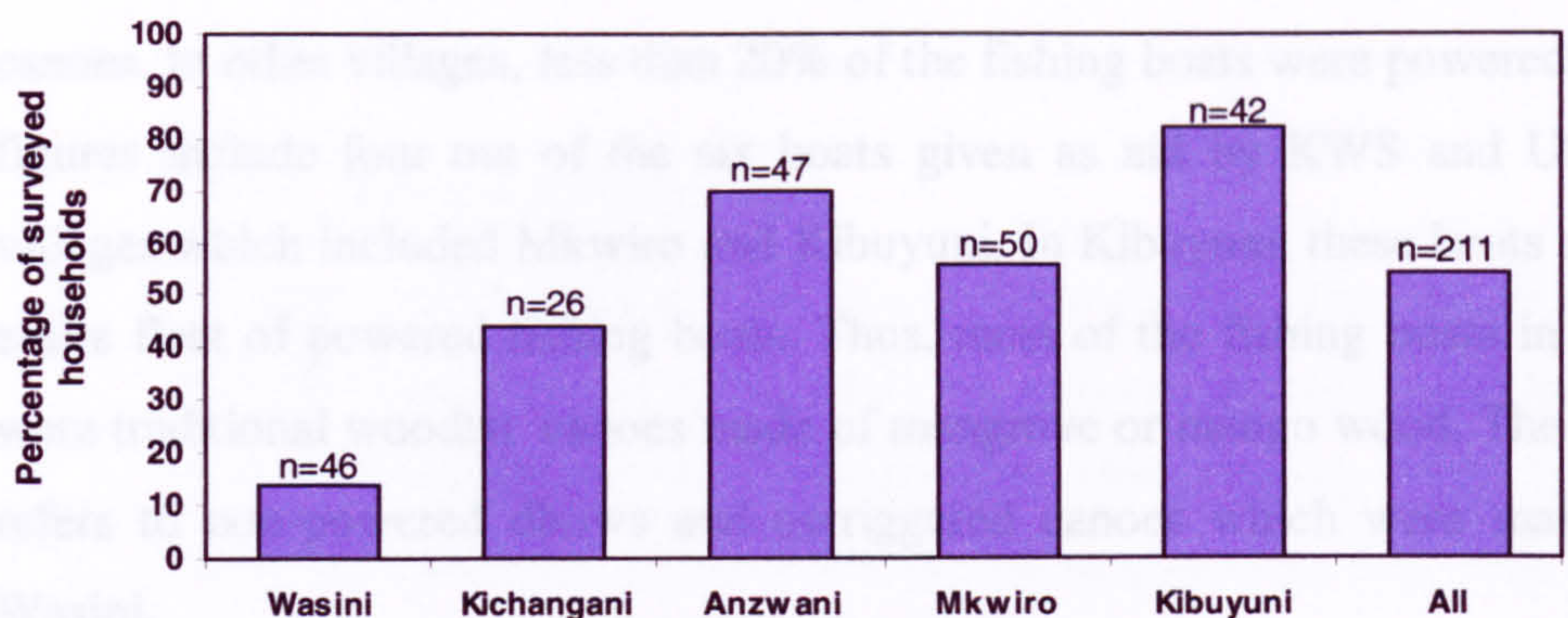
### **5.2.2.1 The boats**

Fishing is the most important source livelihoods of the studied area. A total of 152.5 fishermen (part time<sup>12</sup> and full-time) were found in the 211 households surveyed, and, as illustrated below (fig. 5.2), more than half of these households depended on fishing activities.

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<sup>12</sup> A part time fisher would be counted as 0.5 fisher.

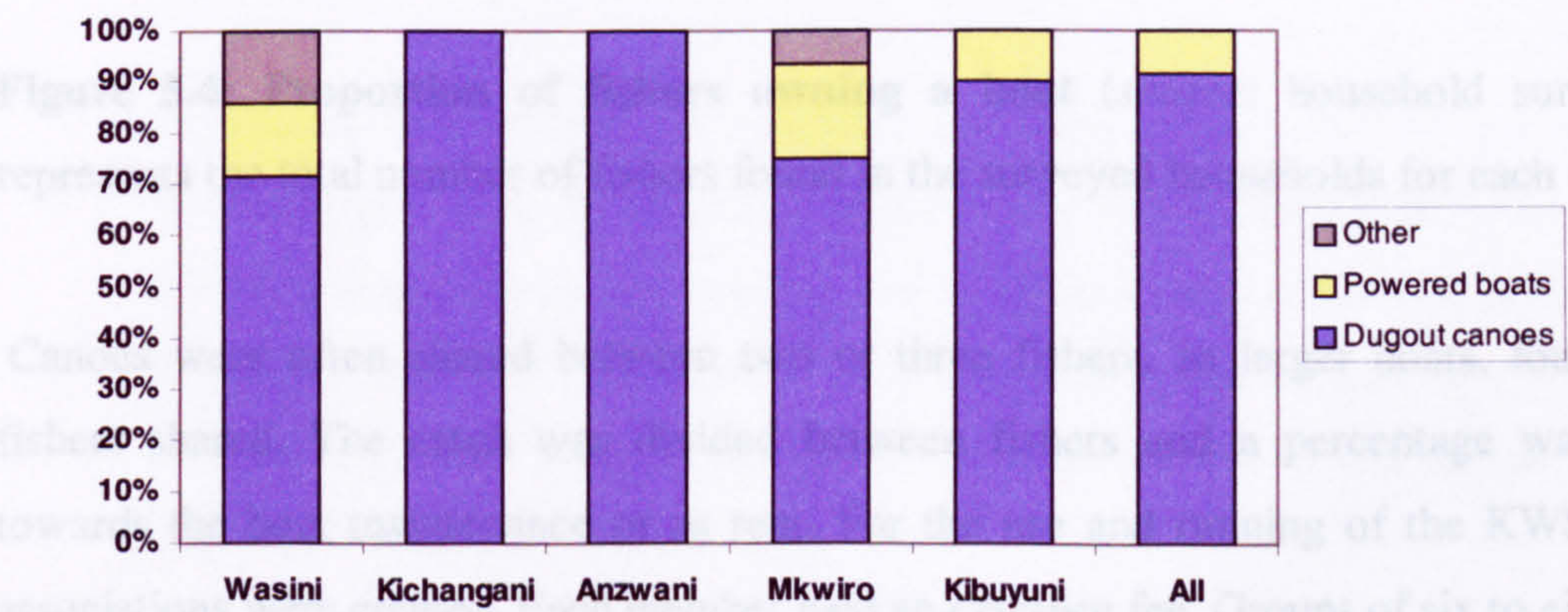




**Figure 5.2: Percentage of households at least partly depending on fishing in each village** (*source:* household surveys; n represents the number of surveyed households in each village)

Wasini was the least fishing dependent community (14%) whereas in Mkwiro and Kibuyuni 56% and 82,6% of the households depended on fishing. Anzwani, the control population, was also one of the most dependent on fishing (69.9%). Thus, except for Wasini, fishing was the villages’ most important source of livelihood.

Very few powered fishing boats were used in the area (see fig. 5.3). It was made clear by the groups that most of the powered boats found in the villages were used to take tourists snorkelling in the KMNP.



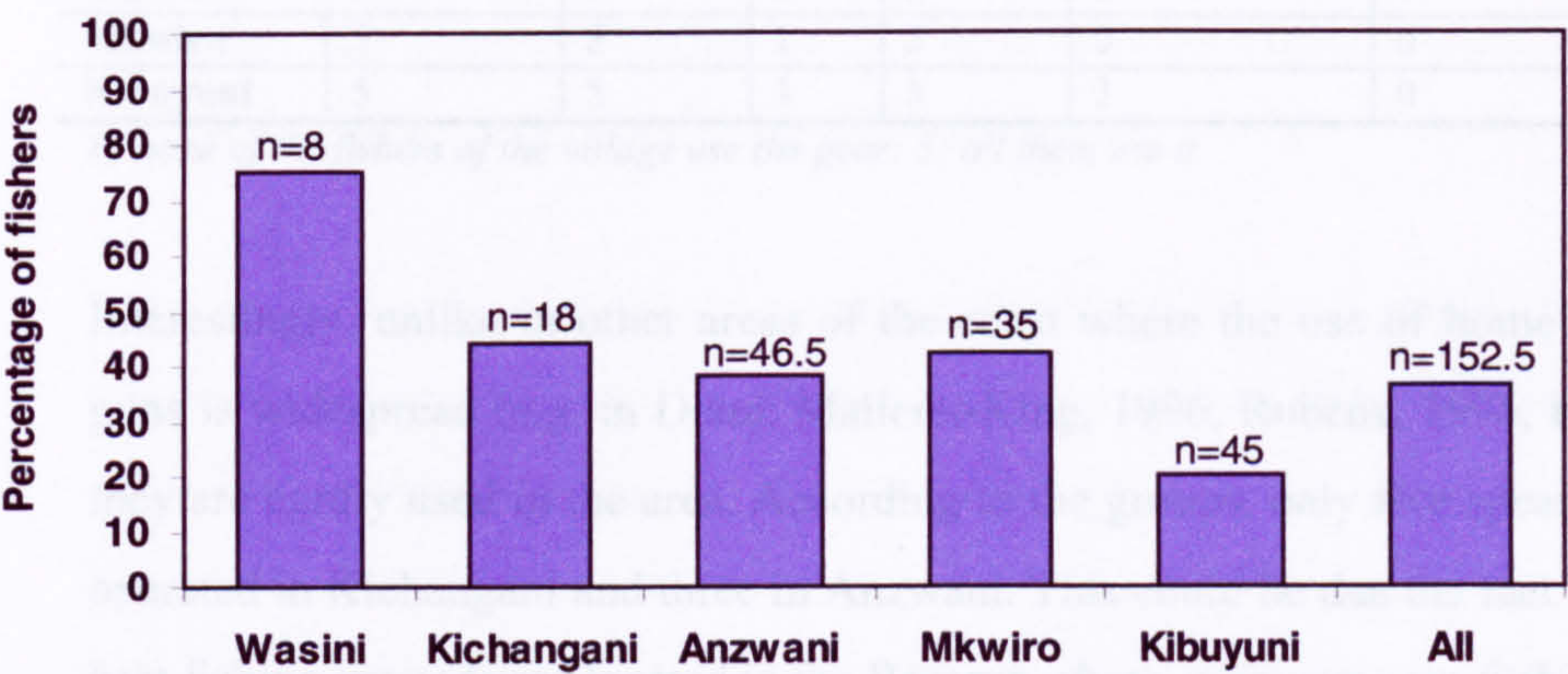
**Figure 5.3: Proportion of powered fishing boats** (*source:* household surveys)



members were not all in one and the groups meted every week. Rental was paid by the fishing group and the catch was divided into two, half for the crew and half for

In Anzwani and Kichangani, the fishing fleet was entirely composed of non-powered canoes. In other villages, less than 20% of the fishing boats were powered. However, the figures include four out of the six boats given as aid by KWS and USAID to three villages which included Mkwiro and Kibuyuni. In Kibuyuni, these boats represented the entire fleet of powered fishing boats. Thus, most of the fishing boats in the study area were traditional wooden canoes made of mangrove or mango wood. The other category refers to non-powered dhows and outriggered canoes which were mainly present in Wasini.

Moreover, the household surveys showed that except for Wasini, less than half of the fishers owned the boat they used (fig. 5.4). However, the situation was very diverse; for example, Kibuyuni had the lowest percentage of owned boats but the village chairman owned a fleet of canoes, which he rented out to fishers.



**Figure 5.4: Proportion of fishers owning a boat** (*source*: household surveys; n represents the total number of fishers found in the surveyed households for each village)

Canoes were often shared between two or three fishers. In larger boats, four to six fishers shared. The catch was divided between fishers and a percentage was given towards the boat maintenance or as rent. For the use and running of the KWS boats, associations were created. Each member paid an entrance fee. Groups of six to eight



members went out at a time and the groups rotated every week. Petrol was paid by the fishing group and the catch was divided into two; half for the crew and half for the association.

**5.2.2.2 The use of fishing gear**

The gear used by fishers of the area is still traditional. The only modernisation has been the introduction of nylon, which has replaced the cotton, and bark traditionally used to make lines and nets (Malleret-King, 1996, Glaesel, 1997). Traps, handlines, spears and tidal weirs are the most used fishing gear in the area (table 5.2). However, predominant gear varies across villages.

**Table 5.2: Comparative use of different gears** (*source: fishers focus groups*)

Village	Handlines	Traps	Nets	Spears	Tidal weirs	Spear guns
Wasini	5	5	1	0	0	0
Kichangani	5	5	0	5	5	1
Anzwani	5	5	2	2	2	1
Mkwiro	5	5	1	3	0	0
Kibuyuni	5	5	1	5	3	0

*0: none of the fishers of the village use the gear; 5: all them use it*

Interestingly, unlike in other areas of the coast where the use of home made spear guns is widespread (e.g. in Diani, Malleret-King, 1996, Rubens, 1996, King, 2000), they are hardly used in the area. According to the groups, only five spear gun fishers operated in Kichangani and three in Anzwani. This could be due the fact that most of best fishing grounds are located in the Reserve where spear guns are forbidden.

In contrast, most fishers use handlines and traps (table 5.2). The use of other traditional gear such as spears and tidal weirs is widespread but differences exist across the communities. For example, the use of tidal weirs is common in Kibuyuni, Kichangani and Anzwani whereas on Wasini Island this method of fishing was abandoned. Reasons given for this by the fishers are that the sea has become rougher (Mkwiro focus group, Glaesel, 1997).

**Handlines** have been used for centuries on the Kenyan coast (Glaesel, 1997). They are ballasted with lead or stones and have several baited hooks attached to them. Bait includes lures, worms, and pieces of octopus or pieces of squid depending on the targeted fish species. In the area handlines are mainly used from boats but also from the shore (youngsters fished from the jetty in Shimoni). When used nearshore, they mostly target small demersal reef fish and when used offshore from larger boats with thicker thread, larger pelagic fish species (e.g. kingfish, large jacks) are caught. Offshore, trolling and set bottom lines are occasionally used. The use of lines can be very strenuous thus, elders rarely use them offshore where large fish can be caught.

**Traps** are of different sizes (from 50 cm up to 2 metres width, Glaesel, 1997). They are hexagonal with a funnel entrance (from 15 to 20 cm in diameter) and are hand made from palm fronds or other pliable woods (Malleret-King, 1996, Glaesel, 1997). Fishers owned 3 to 9 traps depending on the size (Malleret-King, 1996). They are weighted with stones and rest on the seabed over night; they are recovered at low tide. Fishers check from above with a mask and if full, the traps are hooked or lifted inside the boat. Smaller traps are used in shallow areas whereas larger ones are laid near breaks in the reefs at depths up to 30 m (Glaesel, 1997).

**Tidal weirs** are used in the three mainland villages. This is due to the sheltered conditions and the presence of dense mangrove areas on their coastline. The tidal weirs used in the study area are *usio* which are arrow shaped fence structures (over 30 m long), located perpendicular to the shore, the arrowhead pointing towards the sea. Small tightly placed posts tied together with woven doum palm fronds are attached to widely spaced structural posts (about 2 metres high) (Glaesel, 1997). The smaller posts are replaced each year whereas the larger structure can stay several years. When the tide goes out, fish are channelled along the wall of posts into the end of the structure where a net is located. At low tide, the fishers scoop the fish up. This method can be used by fishers of all ages.

**Nets** are relatively recent and were introduced in Kenya at the beginning of the 20th century (Glaesel, 1997). They are less used than the other gear. They require the use



of boats, often very expensive powered boats. Nets in the area include gillnets left overnight offshore (mesh size from 15 cm to 18 cm, Glaesel, 1997), *simu* nets which are very small meshed nets used nearshore to catch seasonal sardine like species, and beach seines which are forbidden on the south coast but are still used (King, 2000, pers. obs.). Younger and middle aged fishers are the ones to use these nets as they are considered as one of the most strenuous method by elder fishers due to the potential load.

**Spears and sticks** are home made and mainly used to catch octopus. In the study area, they are used by men and women at low tide poking into cracks and holes in the reefs. Most fishers caught octopus, particularly elder fishers as it is one of the least strenuous fishing methods. Moreover, this type of fishing does not require the use of a boat (although it was done on a larger scale with a boat) or of other capital items.

The fishing gear described in the above paragraphs presents opportunities and constraints which determine fishers' choice of gear.

#### **5.2.2.3 Economic factors affecting gear choices**

One of the most constraining factors in the choice of a gear is the cost involved in its use. In calculating the cost of a particular gear a fisher has to take account of its duration (regularity of replacements) and of the need to use other capital items more or less costly such as a boats (table 5.3). These costs involved can lead fishers to refuse to comply with the law. For example, the negative reaction the Diani fishers against the establishment of the Reserve (preventing seine nets and spear guns to be used in the lagoon) (Malleret-King, 1996) could be partly explained by the limited alternative method of fishing available to the concerned fishers (Rubens, 1996). Most of them did not own boats nor had the capital to buy the necessary boat to use other traditional gear (Malleret-King, 1996, Rubens, 1996).

**Table 5.3: Costs of the gear\***

<b>Gear</b>	<b>Price</b>	<b>Duration**</b>	<b>Boat requirement</b>
<b>Handline</b>	500 - 1000 Ksh	6 months to 2 years	No (inshore) Yes (offshore)
<b>Traps</b>	Home made to 300-600 Ksh	1 - 3 months	Yes
<b>Tidal weirs</b>	Small: 2000 - 5000 Ksh Large: 5000 - 10000 Ksh	1 year 5 years	No
<b>Spear</b>	Home made	2 years	No
<b>Spear guns</b>	200 Ksh/home made	1-2 years (except the rod)	No
<b>Nets</b>	10 000 Ksh	5-7 Years	Yes- Large and/or powered

\* Adapted from fishers (pers. comm.), Malleret-King (1996), Rubens (1996) and Glaesel (1997).

\*\* The duration of gear varies greatly. Hooks are regularly lost and lines can be broken easily. Nets can be lost but can last several years. The spear of a spear gun is lost easily but the rest can be kept for a year or two. The large structure of the tidal weir can last two or three years. These are just order of magnitudes of the duration of the most costly part of the gear

The need for a boat is one of the largest constraints for a fisher (Rubens, 1996). A standard canoe needed for handlining or trap fishing costs on average 12 000 Ksh if bought, and between 3000 and 5000 Ksh if it is made by the fisher from a purchased log. This represents a very large investment for households whose available income is very low (e.g. in Biga, the fishers' available income was found to be about 22 000 Ksh<sup>13</sup> per year and per active person, Malleret-King, 1996). Canoes last on average 7 to 10 years according to their quality. Larger non powered canoes necessary for net fishing offshore can cost up to 20 000 Ksh and a powered boat costs between 400 000 and 500 000 Ksh to which the running costs have to be added (Rubens, 1996). This is why very few powered boats are used in the studied sites.

In order to lower the costs, in the study area most fishers shared boats between two or three. Moreover, unlike in Diani where fishers had to buy the boats (Malleret-King, 1996, Glaesel, 1997), in the mainland villages (e.g. Kichangani) fishers still have access to wood and make their own boat. This again makes boats more accessible.

The gear price can also be substantial. The yearly cost of tidal weirs is as high as 4000 to 7000 Ksh (i.e. 2000 to 5000 Ksh per year plus 2000 Ksh of amortisment for



the structure to be replaced every five years), compared for example to the price of handlines which is 1000 Ksh (assuming the line lasts more than three months). In order to lower the cost of the tidal weir structure, these are owned by two or three fishers who share the catch.

Gillnets cost on average 10 000 Ksh. In order to replace them every 6 or 7 years (their life span, Malleret-King, 1996), fishers would need to make a yearly provision of about 1500 Ksh. In addition, gillnets require the use of powered boats which would increase the yearly provision of fishers by 29000 Ksh if the boat was to be replaced every 15 years. This is without considering the running costs. Thus, very few fishers own gillnets. These are owned by groups of fishers or have one owner who rents it out to a group of fishers who use large canoes most often non mechanised (e.g. in Anzwani) and share the catch. Most of the fishers using gillnets in the area fish with the gear which was given by KWS.

#### **5.2.2.4 Other factors affecting the choice of gear and the catch**

Cost is not the only factor affecting the choice of gear. Time and energy requirement, season and yield also contribute to the choice of gear made by the fishers.

The age and strength of fishers also determines partly the gear that fishers choose. For example, elder fishers favour the least strenuous or aggressive methods of fishing. They prefer traps (excepts large ones), tidal weirs and spears which are considered as the least strenuous activities (Rubens, 1996, Glaesel, 1997). These fishing methods are also the least time and energy consuming. Some elder fishers used tidal weirs all year round (e.g. in Kibuyuni) although this gear is usually only used during the SE monsoon. The younger fishers prefer gillnets, large traps and handlines. Handlines, spear guns and gillnets were found by Rubens (1996) to be the most time and energy consuming.

<sup>13</sup> This figure includes subsistence productions valued at the market price.



Climatic seasonality (see chapter 3) also affects the choice of gear and therefore the catch in the area (Malleret-King, 1996, McClanahan, 1988). Each gear targets different species (table 5.4). For example, spears are mainly used to catch octopus.

**Table 5.4: Main species mainly caught according to gear type**

Gear/spp.	Handline	Trap	Spear	Tidal weir	Gillnet	Spear gun
Rabbit fish						
Emperors						
Snappers						
Parrot fish						
Groupers						
Grunt						
Jacks						
Shark						
King fish						
Prawns						
Lobster						
Octopus						

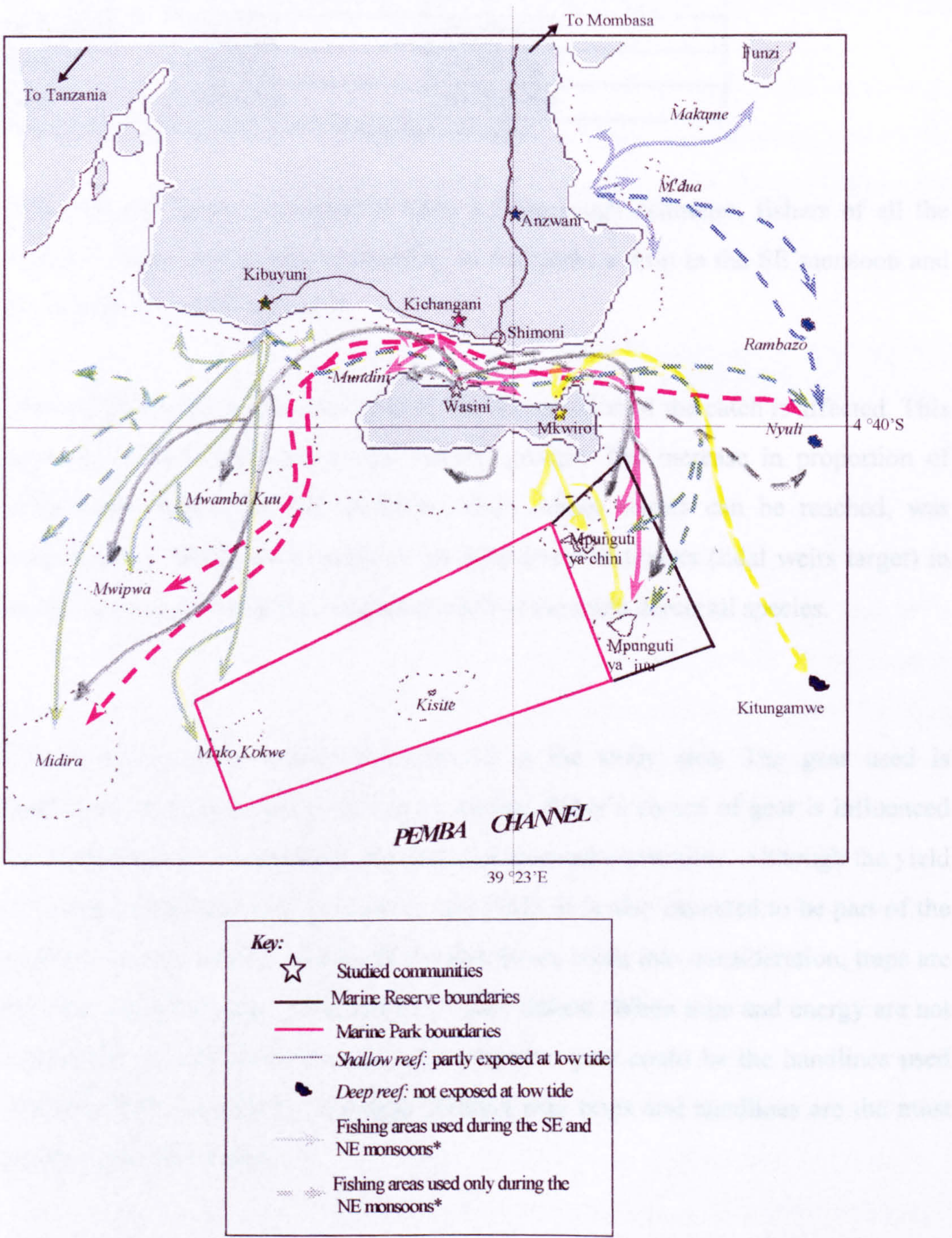
According to the type of gear, where it is used and how it is baited, the targets vary. For example, if the traps are laid in the lagoon on sea grass beds they target mostly rabbit fish, if laid on sandy areas and are baited with crushed sea urchin, snappers will dominate the catch. Handlines used offshore with lures and thick thread can catch pelagics such as large jacks or kingfish. The catch is also affected by the climatic seasonality.

Although in the study area the seasonality of the catch and its composition did not appear strong (Watson, 1996), in the focus groups it emerged as an important feature of the fishery in terms of accessibility of fishing grounds, of the choice of gear, of the catch its composition. For example, nearshore fishing grounds are favoured during the SE monsoon whereas deeper and better fishing grounds (e.g. Nyuli) are more accessible during the NE monsoon (calmer seas).

As illustrated by the figure 5.5, the choice of fishing grounds varies with the seasons. Further away and deeper locations are preferred during the NE monsoon when the sea conditions are better (up to 3 to four hours sailing for Nyuli and 4 hours motoring for Kitungamwe). Similarly, the gear choice varies with the season. For example, tidal weirs are usually used during the SE monsoon when the sea is rougher, whereas



and large traps are favoured in the NE monsoon. A small canoe can easily capsize under the weight and size of such large traps (Glaesel, 1997).



**Figure 5.5: Seasonality in the choice of fishing grounds** (*source: fishers focus groups*). Arrows represent the preferred general areas of fishing rather than specific locations. Fishing occurs all along these directions. Each colour corresponds to a village.



**Table 5.5: Average catch per boat per day according to gear and season**

Season/Gear	Kusi (SE monsoon)	Kaskazi (NE monsoon)
Handline	5-20 Kg	10-50 Kg
Traps	5-30 Kg	20-50 Kg
Nets	10-20 Kg	50-200 Kg

*\*The catch is an average of the results of the group discussions.*

Although the figures presented in table 5.5 are rough estimates, fishers of all the studied villages perceived a seasonality in the catch; a drop in the SE monsoon and an increase in the NE monsoon.

Due to different gear type and location, the composition of the catch is affected. This appeared in the discussion of the fishers' groups. The increase in proportion of pelagic fish during the NE monsoon when deeper waters can be reached, was mentioned as well as an increase of the proportion of Grunts (tidal weirs target) in the SE monsoon in relation to the total catch of the main demersal species.

Fishing is the main source of livelihood in the study area. The gear used is traditional. And, as stated in the above section, fisher's choice of gear is influenced by a combination of economic, physical and seasonal constraints. Although the yield of each gear has not been analysed in this study, it is also expected to be part of the fishers' decision process. When all the factors are taken into consideration, traps are the most attractive gear, particularly for elder fishers. When time and energy are not considered, it was found that the most attractive gear could be the handlines used offshore (Rubens, 1996). This might explain why traps and handlines are the most popular gear in the area.



## **5.3 EVOLUTION OF THE FISHERY**

This section investigates the evolution of the state of fishery described above through the analysis of catch statistics done by Watson (1996) and from the point view of the fishers. The objective is to identify whether a link between the catch evolution and the establishment of the KMNP could be detected.

### **5.3.1 Catch statistics**

#### **5.3.1.1 Methods and available data**

The Fisheries Department operates, as other administrative and technical bodies in Kenya, at the Ministerial, Provincial, District, Location, sub-location and local levels. Yearly fisheries reports are aggregated at the District levels. Disaggregated data is only available at District fisheries offices where monthly reports for each landing site are compiled. The Kwale District Fisheries Office was based in Shimoni which made it easy to access.

The catch is supposed to be weighed every day by fisheries scouts at each landing site. The scouts fill out a form in which they enter the amount of fish and other marine products caught each month in their jurisdiction (several landing sites), the monetary value of the catch, the total amount consumed locally and the amount transported to other areas. The catch composition is detailed. It is divided into three categories; demersal, pelagic and other (e.g. crustacean, holothurians, bivalves etc.) then divided at the family level (e.g. groupers, scavengers...). The form is then sent to the District Office.

The study area corresponded to two fisheries scouts jurisdiction and the data available was divided into two, Shimoni (including Mkwirow, Wasini, Shimoni, Anzwani) and Kibuyuni (comprising Kibuyuni and all the surrounding hamlets).



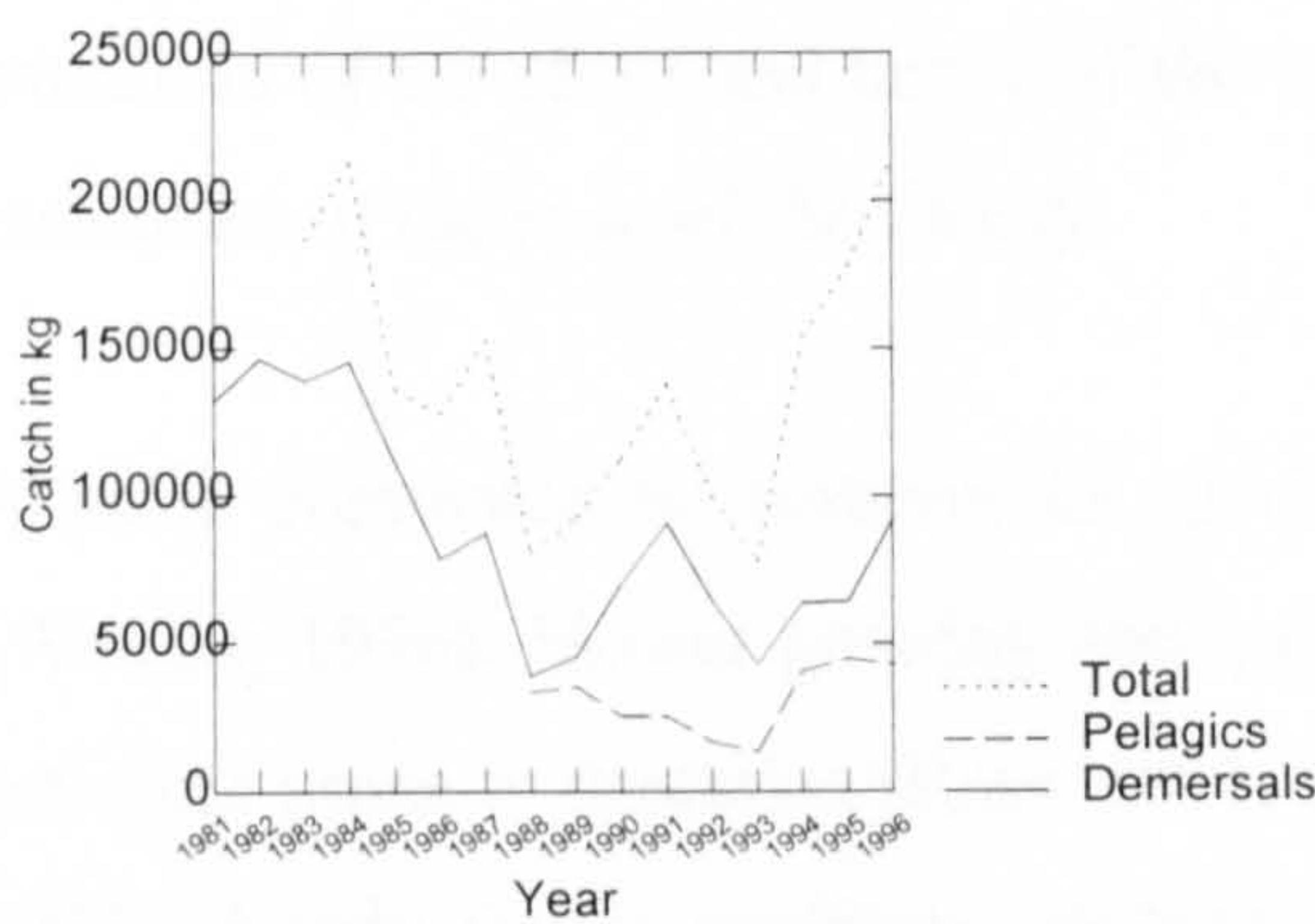
Regular hand written monthly reports for both areas started in 1981. These statistics were used by Watson (1996) to compile the data from 1981 to 1991 for the main commercial species in the area (table 5.6). I compiled the statistics from 1992 to 1996. Watson (1996) also collected her own data (catching fish in the KMNP and in the Reserve).

**Table 5.6: The five main exploited demersal fish in the area**

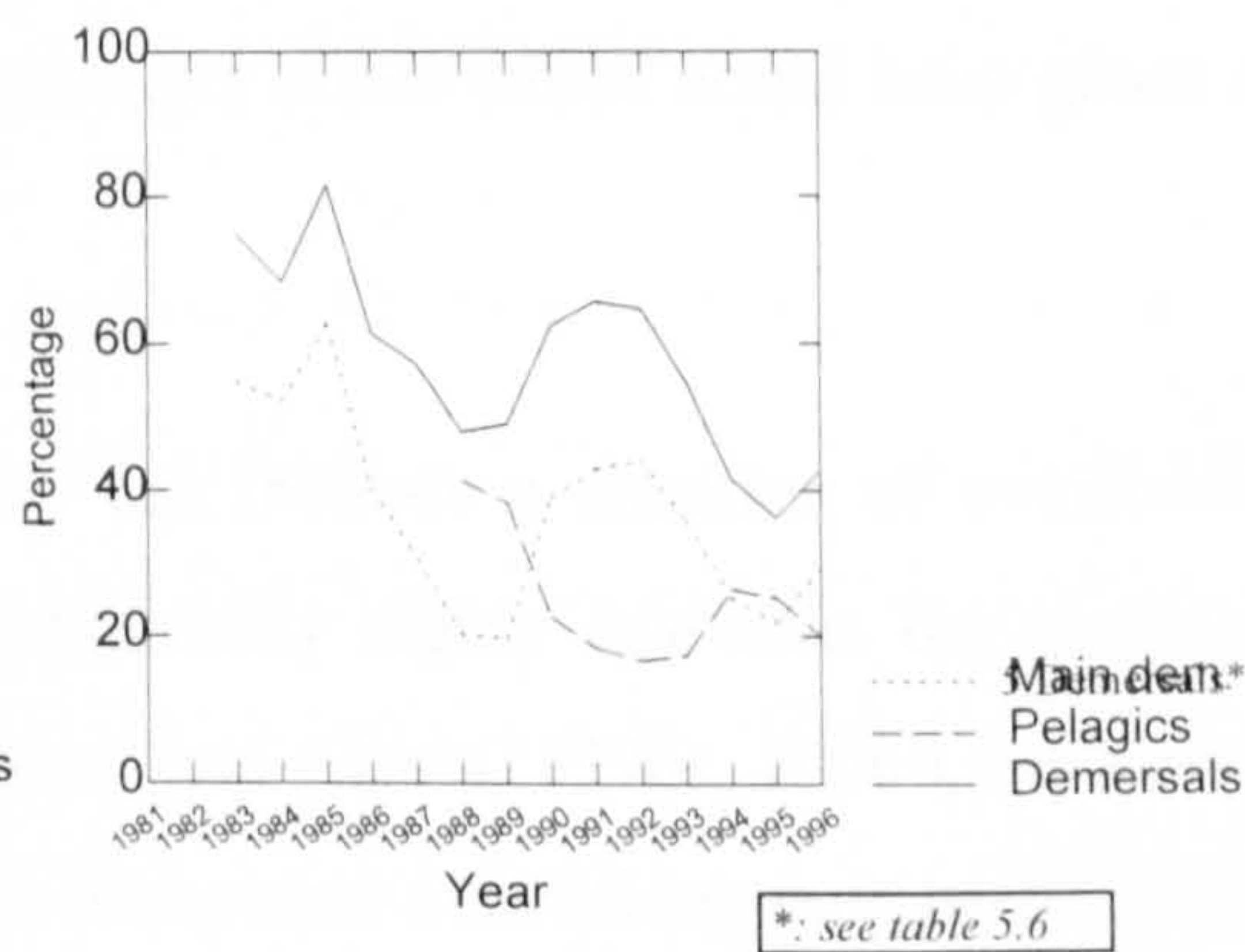
Common name	Swahili name	Family
Rabbit fish	Tafi	Siganidae
Scavengers/Emperor	Changu	Lethrinidae
Snapper	Tembo	Lutjanidae
Parrot Fish	Pono	Scaridae
Grouper	Tewa	Serranidae

**5.3.1.2 Trends and the evolution of the catch based on Watson (1996)**

The demersal catch followed a decreasing trend as well as the total catch until 1989 then the trend is reversed even though fluctuating (figure 5.6a). The proportion of demersal catch in relation to the total catch shows a declining trend since 1981 (figure 5.6b).



**Figure 5.6a: Catch in Kg (1981-1996)**



**Figure 5.6b: Demersal and pelagic catch in percentage of the total catch**



It was thought that the reverse in the trend after 1989 in Shimoni could be due to an improvement of the KMNP<sup>14</sup> enforcement and of the Fisheries law (new Fisheries Act of 1989) (Anon., 1993).

However, the evolution of the fishing effort (1981-1996) could not be estimated from the data collected from the Fisheries Department. Thus, it was impossible to draw conclusions on the state of the fishery as the catch could vary according to the number of fishers. By law, fishers have to licence their boats yearly (Fisheries Act Rev. 1991, Part I.9). It was thought that the number of licences registered at the Fisheries Office could provide an indication of the evolution of the numbers of fishers (Anon., 1993). The registrations showed that the numbers of licences for Shimoni dropped at the same time (1980-1988) as the catch and peaked in 1990. This could suggest that the decline of the catch might indicate a disinterest from fishing rather than an overfishing situation (Anon., 1993).

However, informal interviews carried out with fishers in each of the studied communities made it clear that in some villages, very few of the fishers bothered to get licences. This was the case in Kichangani, Anzwani (both part of Shimoni landing sites) and in Kibuyuni. The consequent unreliability of the number of licences registered at the Fisheries Department makes it difficult to estimate the evolution of the effort and hence of the catch per effort which could have given an indication of the state of the fishery.

A catch dominated by herbivorous species can indicate a situation of overfishing (Watson, 1996). Slower growing and commercially highly desirable, top predators are more prone to depletion (Russ, 1991, Russ and Alcala, 1996a, 1996b, McManus, 1997). A reduction in predators can lead to ecosystem overfishing (see part 1.2.2.1). According to the data presented by Watson (1996) the demersal catch in fished and in unfished areas was still mixed and top predators present (i.e. groupers). This would indicate that the fishery was still healthy at the time of the research (Watson, 1996).

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<sup>14</sup> 1989 is the year when the Park was put under the authority of the Kenya Wildlife Service.



The increase of the catch since 1989 as shown by the fisheries statistics could suggest that the fishery declined then improved since 1989. However, because of the unavailability of information on fishing effort no conclusions can be drawn.

#### **5.3.1.3 On the reliability of the statistics**

Official statistics are not sufficient for analysing the evolution of the fishery since the establishment of the KMNP in 1978. Furthermore, the data do not always relate to reality (e.g. licence numbers).

The Kwale District Fisheries Office is a very small unit which employs 8 people and whose equipment is very limited. The role of the Fisheries Department is to enforce the fisheries law and collect catch data. However, as fisheries are not a priority at a national level, few resources are devoted to their management. For example, it is difficult for the Department to enforce the law without boats. To solve a difficult situation, a Memorandum of Understanding was signed with KWS which meant that, on the request of the Fisheries Department, KWS boats and staff could be used to arrest illegal fishers. This arrangement is not always effective and I have personally often observed seine net fishers (now illegal on the southern coast of Kenya) operating directly in front of the Fisheries Department buildings.

The collection of fisheries data is the role of fisheries scouts. They are supposed to weigh the catch landed in their jurisdiction five days a week (Glaesel, 1997). They fill in a form which they send monthly to the District Office and which is the basis for the District and Provincial (Mombasa) yearly reports. In reality however, it is rare for fisheries scouts to appear five times a week at each landing site (Malleret-King, 1996, Glaesel, 1997, King, 2000). For example, every time I went to Kibuyuni (over a period of a year), the scout was away for personal matters, and days when data are not collected are not taken account of (Glaesel, 1997).



Furthermore, the lack of resources prevents the scouts carrying out their activities. Most of the staff in government offices are poorly paid (as are fisheries scouts) (Malleret-King, 1996, King, 1997, Glaesel, 1997). Thus, they often have to develop side activities in order to make a living, and are hence not motivated to do their work conscientiously. Moreover, the fisheries scouts' tasks can be impossible to achieve. For example, in Diani two scouts have to survey 35 landing sites five days a week, at the same time<sup>15</sup>, but have no vehicle. It is unlikely that any of the sites were visited every week (Fisheries Officers, pers. comm.). In addition, the catch sold by the fishers before landing (straight from the boat) or brought home is not accounted for and it is estimated that at least 30% of the catch is not taken into consideration when measured (Glaesel, 1997). The catch is therefore biased downwards. However, it is impossible to know whether the bias is consistent as none of the scouts mark the days when they do not go to a site. They send an aggregated monthly report to the District Office. For all these reasons, the catch reported monthly is unlikely to be reliable.

The problems faced by the Fisheries Department occur at all levels. Lack of motivation also affects managerial staff. The senior staff is appointed in a region regardless of cultural or professional background. They are moved on average every four years. This lack of consideration for the staff's background results in negative feeling towards the job. For example, one of the staff in Shimoni, is from Western Province. He had always worked on the Lake fisheries and had received special training in freshwater prawn farming. Dealing with marine fisheries meant acquiring a totally new knowledge base knowing that he would be moved on. Being appointed to the coast also meant working amongst a totally different culture (different tribes, different religion) whilst his family had to stay in his home territory where they had to secure their land. Hence, this situation was not conducive to enthusiast or innovative management and resulted in a waste of skills.

Finally, it is difficult to trust the data available when the Assistant Fisheries Director admits that the data are meaningless (Assistant Fisheries Director, pers. comm.)

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<sup>15</sup> Fishers usually fish at low tide and all come back with the incoming tide.



Incomplete and unreliable data resulting from lack of financial resources and personnel mismanagement are not uncommon in developing countries where fisheries are not considered as a priority. However, incomplete data are also found in developed countries (Glaesel, 1997). This is why, in order to assess the evolution of the state of the fishery it was decided to interview fishers and investigate their perception of the evolution of the resources and whether they identified a link between the evolution and the presence of the KMNP.

### **5.3.2 Evolution of the fishery as perceived by the fishers**

The evolution of the fishery in the last 20 years was extensively discussed in the groups. The changes between *zamani* (the past, before) and now perceived by the fishers and an elder fishmonger are summarised below.

#### **5.3.2.1 Perceived signs of decline**

The first change the groups mentioned was the presence of the KMNP: “*now there is a Park, before there was none*”. Its presence affects the availability of the resources as the best fishing spots considered to be Kisite and Mako Kokwe (see fig. 5.5) are now in the KMNP. In terms of the changes concerning specifically the fishery, all the groups mentioned the change in the price of fish: “*before there was lots of fish but not a lot of money, now there is no fish but more money*”. The old fishmonger interviewed confirmed this trend. According to him, some prices in Shimoni have been multiplied by 10 and even by a 100 for large prawns in the last thirty years. Prices of fish vary according to size and desirability (e.g. the tourism industry is keen on kingfish and sailfish, see table 5.7).







As described by Malleret-King (1996) the octopus market has recently developed with the presence of processing companies and retailers inciting local fishers to catch octopus. Two main companies operate on the southern coast of Kenya. They sometimes provide powered boats and iceboxes to local fishers. They also provide freezers to some fish traders (Malleret-King, 1996). In the study area, the octopus caught is collected everyday at the Shimoni market. There are approximately 25 collection points along the coast. Octopus is sold on average 60 Ksh per kg thus more than the price of large demersal fish. The octopus are washed and frozen in Mombasa and then exported. One of the companies exported 20 tons of frozen octopus per month to Europe which was sold in 1996 at USD 3.68 per kg. This development has provided the local fishers with a new outlet.

The sea cucumbers, as the octopus, are mainly destined to foreign markets. Sea cucumbers are collected by divers, boiled, dried and then sold. They are one of the most expensive marine products. A fisher sells them for 180 Ksh/kg and they are sold from Mombasa market at 1000-1500 Ksh per kg. This is a product collected exclusively for export to the Chinese market. Chinese people came and showed local fishers how to process the sea cucumber to satisfy the demand.

It is thus suspected that the change in the marine products composition on the market is partly due the overfishing (e.g. decline of the proportion of prawns and lobsters) and to the development of new markets in the area (i.e. octopus and sea cucumbers).

#### **5.3.2.2 Tentative explanation of the situation by the users**

Potential reasons for the decline of the catch were also discussed with the groups. Three groups mentioned an increase in the number of fishers as the cause of decline. It was interesting to note that, when asked, elder fishers said that the younger generation did not want to enter the fishery as they were educated and would rather be employed. However, jobs were scarce and a lot of them had to turn to fishing. In Kichangani, some participants to the focus group were young fishers. When asked if they would rather be employed, their answer was that they saw a lot of advantages in



fishing such as being your own boss and being able to get in one lucky catch the equivalent of a month's salary. The fishmonger's perception of the evolution of the numbers of fishers was similar to the groups' opinion. He felt that in Wasini, the number of fishers had reduced dramatically, that in Mkwiro it had stayed stable or had increased slightly and that in the other studied villages it had increased substantially. However, he did not see in the increase of the number of fishers a reason for the decline of the catch.

Three of the focus groups thought that the reduced catch was partly a result of the use of destructive and aggressive gear such as spear guns (hardly used in the area) and seine nets. According to them, although seine nets were now banned, they had done a lot of damage until recently and were sometimes still used. For the fishmonger, the angle was slightly different. His explanation of the reduced catch was that seine nets had been banned whilst they used to bring most of the catch. This ambiguous situation had been observed in Diani, where seine nets had been banned and fish traders had less fish to sell in the short term (Malleret-King, 1996).

A reason given by one of the groups was that the younger generation of fisher did not respect traditions (e.g. sacrifices, ritual ceremonies). However, when traditional management practices likely to restrict fishing in place or time were discussed further, Anzwani fishers' answer summarised the attitude of most of the fishers interviewed: *"years ago, we were so few fishers and there was so much resources we did not need to restrict fishing or to manage the resource. Today, there is so little resource and so many fishers that we cannot afford not to fish..."* Traditionally, it was forbidden to fish lobsters during the month of June in Anzwani. Nowadays there is no restriction...but there are no lobsters either.

When Glaesel (1997) investigated whether on the southern coast of Kenya any of the existing beliefs, taboos, superstitions or traditional practices could have had a *de facto* effect on the management of the fishery, it was found that most of them related to safety (e.g. not fishing at night), social order (e.g. not disturb other fishers gear), fishing skills (e.g. not make noises when fishing), or religion (e.g. no fishing on



Fridays). Many other taboos and their role were analysed by Glaesel (1997) but none was found to be of importance in the sustainability of the fishery.

Traditions regulating the relationship between fishers and the environment were thought not to be sufficient to have an effect on the state of the marine resources (Glaesel, 1997). However, witchcraft is a very important part of the Digo culture and fishers groups, particularly in Kibuyuni, were not always keen to speak about these practices. Hence, some practices might have not been mentioned to me, an outsider.

In terms of the evolution of the effort, discussions with the groups and the fishmonger suggested that the number of fishers had increased overall. The intensity of fishing had also increased. Both observations would suggest that the fishing effort had increased in the last decades. Overall, fishers think that the fishery has declined rather than improved. This has been repeated over and over again independently by each group and by the fishmonger. This information can be interpreted as an indication of the poorer state of the fishery, which cannot be deduced from the Fisheries Department statistics.

The analysis of the fisheries statistics was not sufficient to draw conclusions on the evolution of the state of the fishery since the KMNP establishment in 1978. Moreover, the reliability of the available data was put into question. This led to the idea of investigating the state of the fishery from the point of view of the resource users. These showed that fishing was the most important activity in the area, that it is still traditional (very few powered boats used and use traditional fishing gear) and that the fishers' choice of fishing methods are dictated by several constraining factors (economic, physical strength, season and yields).

Finally, fishers' perception was that the catch per fisher had declined over the years and that more effort had to be put into getting the same catch. This could not be identified through the analysis of the fisheries statistics. The fishers attributed this



decline to the increase in effort, the use of aggressive fishing methods and to the decline in the traditional practices.

## **5.4 CONCLUSION**

Both the biological study of the potential role of the KMNP in the replenishment of the surrounding fisheries and the study of the fishery's evolution through the catch statistics gave insufficient results to draw conclusions on the improvement or not of the yields around the KMNP.

Similarly, the fishers detected no links between the KMNP and the state of the fishery. When the evolution of the fishery was discussed, all the groups mentioned the KMNP as one of the important changes in the fishery's landscape. But none of the groups identified an eventual contribution of the KMNP to the catch. When fishers were interviewed on the effects of the KMNP, one group observed a difference between the fish caught in the vicinity of the KMNP and the fish caught further away. Otherwise no mention was made of the fishery.

The interviews did not provide enough information on whether the current state of the fishery is worse now than before the establishment of the KMNP or whether the state of the fishery could be linked to the presence of the KMNP. Moreover, the results of the group interviews about the state of the fishery could have been biased by a "good old days" attitude whereby fishers (and people in general) often think that it was much better before than it is today, having forgotten the hardship of before.

However, even though no conclusions can be made on the relationship between the catch and the KMNP, some results can be drawn from the interviews. Firstly, fishers' attitudes towards the KMNP varied according to factors such as aid received, alternative employment (i.e. KMNP-related tourism) and potentially according to the accessibility of the KMNP boundaries (e.g. for Kibuyuni). After twenty years, three



villages out of the five studied were still discontented about the presence of the KMNP. Secondly, the amount of fish caught per fisher inshore had declined.

The establishment of MPAs is a major perturbation for local communities' traditional ways. It is often imposed on them. Thus, they see it as a forceful action. After 20 years of relationship with the KMNP, the benefits do not appear clearly to the stakeholders. The main changes have occurred in terms of economic activities (growth of tourism-related employment) and aid.

The case of the KMNP shows that it cannot be assumed that MPAs and subsequent NTZs are seen as beneficial by surrounding communities. Thought needs to be put into finding ways of taking local people's perception of MPAs into consideration. Their attitudes are often dictated by socio-politico-economic factors. Another way of looking at and monitoring the impacts of MPAs on surrounding communities could be through socio-economic indicators such as food security indicators.



## 6 Measuring Household Food Security

The concept of food security evolved dramatically between the 1970s and the 1990s. A similar evolution has been followed by the available indicators of food security. The first part of this chapter presents these indicators emphasising their advantages and drawbacks. The concept of food coping strategies and its advantages in the detection of food insecurity are discussed. Finally an index using coping strategies to measure food insufficiency is introduced.

The second part of the chapter describes the way indices were adapted and designed to evaluate the food security situation of the studied communities. The objective was to compare the situation of these communities in order to detect the potential effects of the KMNP on them from a socio-economic point of view.

### 6.1 AN ARRAY OF FOOD SECURITY INDICATORS

Household food security is now defined as: “...*all people at all time have physical and economic access to adequate, safe and nutritious food for all household members, without undue risk of losing such access*” (FAO, 1996a). The concept of household food security as defined above is complex and comprises such notions as sustainability, vulnerability or security, food sufficiency and access to food (Maxwell, 1996). To make a complete food security analysis is virtually impossible (Maxwell, 1996) but in order to detect, predict and prevent crises it is essential to be able to monitor it (Nyborg and Haug, 1995). In an attempt to assess and monitor food security, an array of indicators has progressively been developed.

Food security indicators have evolved along with the definition of food security (see chapter 1). They have acknowledged a paradigm shift and, from focusing on food



supply only they now concentrate on measuring access to food (Maxwell and Frankenberger, 1992).

### **6.1.1 Food supply indicators**

Existing indicators are usually classified into the two main categories of process and outcome indicators (Maxwell and Frankenberger, 1992, Nyborg and Haug, 1995). Process indicators reflect the likely impacts of an event/situation on food security (e.g. a shortfall of rain) and outcome indicators reflect progress towards or away from food security (e.g. household budget) (Nyborg and Haug, 1995).

#### **6.1.1.1 Process indicators at the macro level**

Interest in monitoring food security appeared as soon as the end of the 19th century (Maxwell and Frankenberger, 1992). In India, the colonial government looked for ways of detecting early chronic famines in order to put preventive measures in place (De Waal, 1989). The system designed was based on a wide range of indicators such as market prices, rainfall and agricultural production (Davies *et al.*, 1991a).

In the 1970s, an extensive drought in Sub-Saharan Africa resulted in a shortage of food supply, this event led to the belief that food production was the key factor in detecting food insecurity (Davies *et al.*, 1991a). A wide range of food supply indicators were thus developed and the first early warning systems (EWS) were created (Davies *et al.*, 1991a). These were based on food deficit models which assumed that food insecurity could be measured by the extent of the deficit in food supply at a macro level, and that, the crisis at the micro levels would be translated directly into nutritional deficiencies (Shoham and Clay, 1989). Thus, nutritional surveillance systems, particularly focusing on malnutrition of children, were established in most developing countries with the objective of helping to detect these crises (Mason *et al.*, 1984).



The indicators used to monitor food supply at the macro levels and to predict potential food crises are process indicators. They include food balance sheets, rainfall, agricultural productions, the state of natural resources, pest damage, the state of the market and institutional support structures, socio-political situations (i.e. conflicts or war) (Maxwell and Frankenberger, 1992, Nyborg and Haug, 1995).

These indicators can provide invaluable information in terms of detecting and predicting potential food crises but they also have numerous limitations. These are mainly that their level of aggregation cannot reflect food insecurity at smaller levels (Borton and York, 1987) and that an indicator adequate for a region might not be adapted to another region (Staatz *et al.*, 1990). For example, rainfall might be a good detector of potential shortage of food supply in a drought prone area but not in another region (Maxwell and Frankenberger, 1992). Moreover, total rainfall is not always correlated with yields in drought prone areas. Rainfall can only give valuable information if the rain distribution is also taken into consideration (Mason *et al.*, 1984). Often, data on agricultural production gathered at the national level only takes account of the major staples (e.g. maize, wheat) and ignores crops which can play an important role in food security (e.g. tubers), thus a drop in agricultural production is not always translated into food insecurity (Frankenberger, 1985). Finally, it was realised that nutrition surveillance systems could only give indications on the fact that a crisis has happened (often there is a time lag before the nutrition deficiency signs appear) and did not give information on the causes of the crisis (UNICEF, 1991).

#### **6.1.1.2 Outcome indicators at the micro-level**

It was realised that crises at the micro level failed to be detected by indicators at the macro levels. Thus, outcome indicators were developed in the 1980s. They are considered as proxies for food consumption indicators (Nyborg and Haug, 1995). They can be direct (i.e. household budget and consumption surveys, household perception of food security, food frequency assessment) or indirect (i.e. storage estimates, subsistence potential ratios, nutritional status assessments) (Maxwell and



Frankenberger, 1992). Up to now, most studies have relied on food consumption to monitor household food security using mainly the household budget and 24 hour recall methods (Maxwell, 1996).

Direct outcome indicators can be useful in the detection of food insecurity, although it is admitted that they are very time consuming, costly and do not always reflect household food security (Maxwell and Frankenberger, 1992, Maxwell, 1996). For example, household budgets only rely on bought products to estimate the household food consumption whereas subsistence production can have an essential role in providing food to the households (Maxwell and Frankenberger, 1992, Maxwell, 1996). 24 hour recall used to make food frequency assessment is done by interviewing some household members about the types of food consumed in the past 24 hours. These foods are then analysed to estimate the food calorie intake (Maxwell and Frankenberger, 1992). Although this latter method takes into consideration subsistence production it is highly dependent on informant bias and memory lapse for precision (Maxwell, 1996). Moreover, it is often impossible to aggregate 24h recall data to the household levels as the food frequency intake varies according to the household members (Maxwell, 1996).

Micro-level indicators such as outcome indicators are difficult to aggregate at the national level, they are location-specific and thus make it difficult to compare situations across regions (Maxwell and Frankenberger, 1992). Finally, outcome indicators as process indicators concentrate on only one aspect of food security which is food sufficiency.

### **6.1.2 Socio-economic and Access indicators**

To overcome some of the problems of outcome indicators, Haddad *et al.* (1994) investigated alternative indicators. Their aim was to find reliable, cost minimising, easy to collect indicators. The indicators tested were mainly socio-economic (e.g. household size, dependency ratio, asset ownership) and it was found that relatively



simple indicators gave enough information to locate vulnerable households: “*the number of unique foods consumed, region, dependency ratio, household size, rooms per capita, incidence of illness, vaccination status, age at weaning, drinking water, sanitation facilities-all coded with only two or three values*” (Haddad *et al.*, 1994: 343). The main limitation of these indicators is that they are location specific and might be more reliable if used in conjunction with one another (Haddad *et al.*, 1994, Maxwell, 1996). They however go beyond the food sufficiency and include an element of vulnerability.

The Sub-Saharan Africa food crisis of the mid 1980s occurred when the food balance sheets were positive (see chapter 1). This showed that food security was not only dependent on food sufficiency at the macro levels. The concept of food entitlements formalised by Sen (1981), extended by Dreze and Sen (1989) and Swift (1989) contributed to explaining how access to food was an essential component in the achievement of food security. Food entitlements are ways in which the households have access to food (e.g. income, savings, subsistence production, assets, community support (claims) or natural resources...). In addition, the concept of vulnerability was developed and helped to show that the vulnerability of the households to a crisis depended on the past (e.g. previous crisis and strategies used in previous crises) as well as on the present (Swift, 1989). Moreover, it was realised that households are not passive to stress, that they use strategies to cope with a crisis (Devereux, 1993). All these advances in the understanding of food security contributed to the development of indicators which focus on access to food and particularly on the way in which households cope with a crisis.

Coping strategies are defined as “*short term temporary responses to declining food entitlements*” (Davies, 1993). Monitoring responses to food shortages (i.e. coping strategies) aims at detecting a sequence of strategies which could indicate early diminishing food access (Nyborg and Haug, 1995).

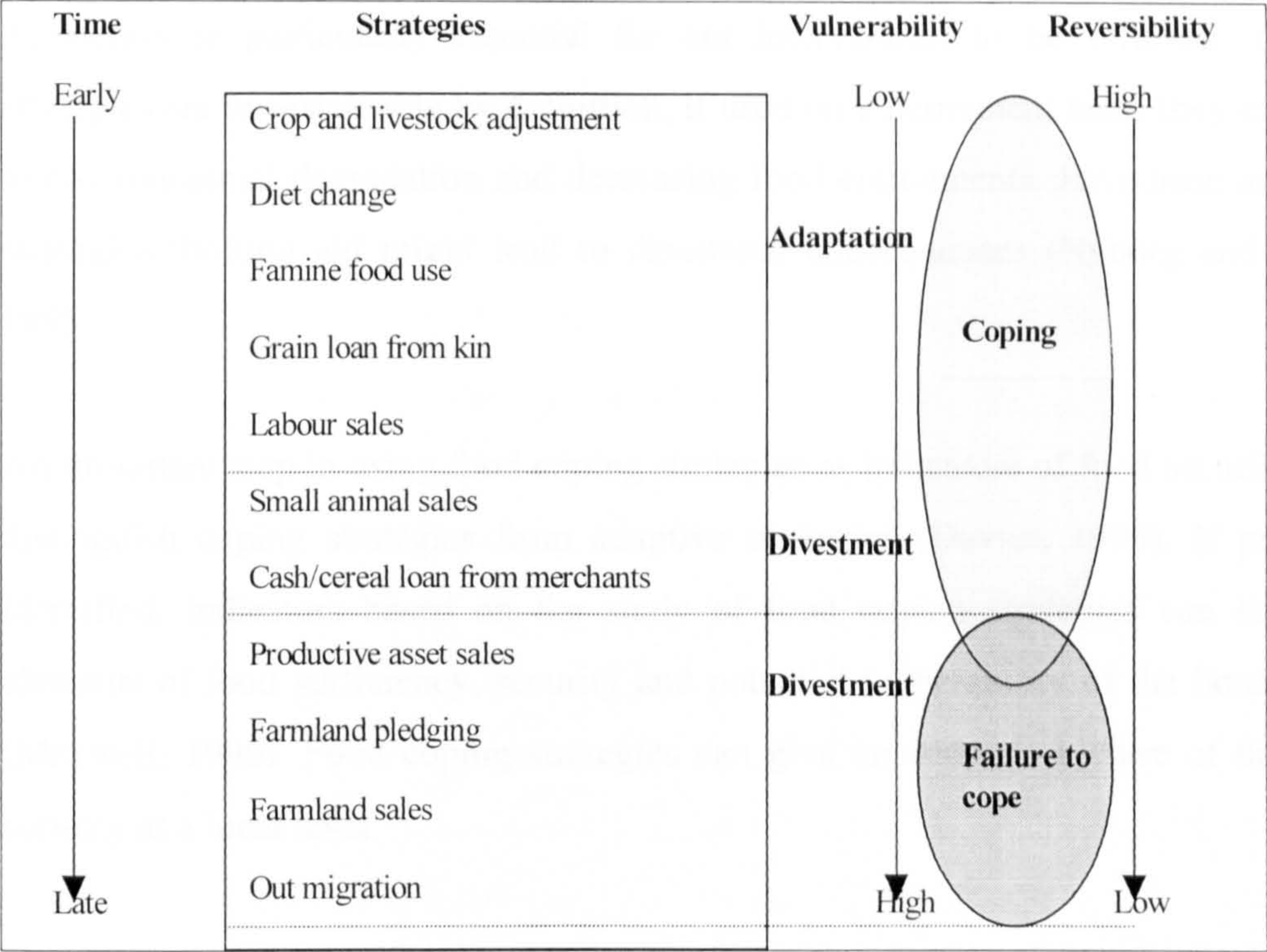
Coping strategies can vary from place to place and from crisis to crisis but they often include changes in diet, in production systems, sale of productive assets (assets that



play a role in generating income such as land and equipment) and of liquid assets (asset that represent a store of values such as jewellery or small animals), migration, adaptation of household size and composition (Watts, 1983, Caldwell *et al.*, 1986, Corbett, 1988, Frankenberger and Goldstein 1991, Maxwell and Frankenberger, 1992, Davies, 1993, Devereux, 1993, Haddad *et al.*, 1994, Nyborg and Haug, 1995, Maxwell, 1996). However, although the types of coping strategies used world-wide are similar, their sequence is by no means universal (Nyborg and Haug, 1995). Patterns of responses are locally specific and depend on numerous factors such as the livelihood systems, religion or socio-economic profiles (e.g. poor or rich) (Maxwell and Frankenberger, 1992, Davies, 1993, Nyborg and Haug, 1995, Maxwell, 1996).

To become a useful monitoring tool, the sequence of responses to food shortage the sequence is generally divided into three stages (Corbett, 1988, Maxwell and Frankenberger, 1992, Devereux, 1993). These stages reflect the degree of commitment of domestic resources and the reversibility of these strategies. For example, at early stages of the crisis, risk minimising strategies are used (e.g. reduce consumption, eat least favourite foods), if the crisis continues, more commitment is made in order to meet subsistence needs (e.g. sale of liquid assets, sale of productive assets) which makes it more and more difficult to come back to the pre-crisis stage (Maxwell and Frankenberger, 1992). In the late stage of the crisis, destitution (e.g. land sales) and distress migration can occur indicating the households have failed to cope (Maxwell and Frankenberger, 1992, Nyborg and Haug, 1995).





**Figure 6.1: Example of a sequence of coping strategies** (*source*: adaptation from Watts (1983), Maxwell and Frankenberger (1992), Davies (1993) and Nyborg and Haug (1995)).

However, like other micro-level indicators they are difficult to aggregate and compare across regions as they are very location-specific (Maxwell and Frankenberger, 1992, Davies, 1993). Food coping strategies are used more and more in the analysis of food security (Nyborg and Haug, 1995), but some precautions are needed when interpreting a study of food coping strategies.

Food security is only part of the target of household to reproduce the livelihood system on which they rely (Davies, 1993). A distinction needs to be made between a stable household which might use coping strategies to try and go back to a pre-crisis stage, and an unstable household which might have to use coping strategies on a permanent basis thus evolving towards a new household system (Nyborg and Haug,



1995). The latter then called adaptive strategies (Davies, 1993), become part of a new livelihood system or a shifting livelihood system (Maxwell, 1996). This distinction is particularly essential for aid intervention to be efficient. Coping strategies are unsustainable by definition, if used on a permanent basis they can lead to environmental degradation and decreasing food entitlements. Favouring adaptive strategies through aid might lead to disastrous consequences (Nyborg and Haug, 1995).

An important step in using food coping strategies as indicators of food security is to distinguish coping strategies from adaptive strategies (Davies, 1993). If properly identified, indicators based on the study of food coping strategies can combine elements of food sufficiency, security and potential vulnerability of the households (Maxwell, 1996). Food coping strategies can give an accurate picture of the food security at a local level.

### **6.1.3 Using food coping strategies**

Although a lot has been written on the significance of food coping strategies, little has been written on their use in measuring food security (Maxwell, 1996). In 1995, Maxwell (1996) developed a food security index based on the frequency of use and the perceived severity of short term food coping strategies. The ultimate objective of the indicator was *“to compare the food sufficiency between two urban groups; those who have access to land for semi-subsistence farming and those who do not”* (Maxwell, 1996: 297). Semi-subsistence farming was considered as an adaptive strategy, the study focused on determining the impact of such a strategy on the households.

Maxwell (1996) found significant relations between the food security scores, the income levels and the seasonal variations in food availability and price. Significant correlations were found between the food security index and commonly used dietary and nutritional indicators (based on anthropomorphic measures such as the weight to



height ratio and the age to height ratio in young children). The food scores were also correlated with the household size an alternative indicator previously tested by Haddad *et al.* (1994).

Although the index was not considered as perfect to do a comprehensive analysis of food security and particularly of household vulnerability, it was considered as more adequate than existing measures (Maxwell, 1996). It was easy to use, it enabled longer recall periods than outcome indicators, it could be used in conjunction with other methods. Most importantly, it provided information about the vulnerability of the households, particularly, it gave good indication of the risk of food insufficiency and the cumulative consequences of repeated use of coping strategies (Maxwell, 1996).

However, several drawbacks were found. Problems of assigning cardinal values to ranked values and of interpreting the meaning of qualitative rankings (i.e. the frequency scale) were invoked. To tackle these problems, scoring instead of ranking the severity of the strategies, and giving a more precise frequency scale was suggested (Maxwell, 1996). Another problem was that the index only took account of very short term coping strategies. In order to have more information on the vulnerability of the households, it would be necessary to investigate adaptive strategies used, as they can include diversification of income sources and risk minimising strategies (Maxwell, 1996). Investigating further adaptive strategies could be done by calculating a separate index, there might however be a trade off on the practicability of the analysis (Maxwell, 1996).

The index used by Maxwell (1996) to compare the food security situation of two groups of households showed a way to use food coping strategies to measure food security. His encouraging results suggested a way to investigate the impacts of the Kisite Marine Park on the surrounding fishing communities from a food security point of view.



## **6.2 DESIGNING THE FOOD SECURITY INDICES**

The objective of the quantitative analysis of the five selected fishing communities' food security is to detect differences between communities which could be attributed to the presence of the KMNP. Short term socio-economic profiles as well as longer-term evolution of the households' situations were investigated.

To do a quantitative analysis of the effects of the park on the surrounding fishing communities, four indices were designed. They were adapted from the index pioneered by Maxwell (1996). A short term food coping strategies index was developed. In order to gain a more comprehensive knowledge of the vulnerability and potential resilience of the households, an indicator based on the responses to longer term crises was also created. Moreover, to increase the sensitivity of the analysis to non-crisis situations, accumulation indices (short term and long term) were also designed. By investigating the accumulation strategies of the households in the short term and longer term, more detailed comparison of the households' situation could be carried out.

### **6.2.1 Methods**

The indices were all designed on the same principle and based on the frequency of use and severity of the strategies used. A food coping strategies index (FCSI), a short term accumulation index (STAI), a long term accumulation index (LTAI), and a long term divestment index (LTDI) were designed. In-depth interviews and focus groups were used to design a questionnaire on which the calculations of the indices were based.



#### **6.2.1.1 Interviews**

In-depth interviews were used to identify the strategies used by the households. In the study sites, women were responsible for the preparation and distribution of food in the household, they were the ones who dealt with food shortages and decided on the households' short term responses to these shortages or surplus. Thus women were considered to be the most appropriate informants. Three households were randomly selected in each village. Their economic background was checked with the help of the village chairman or of a teacher (e.g. in Mkwiro), so that poorer and wealthier households' strategies could be identified.

The aim of the in-depth interviews was to understand the households' consumption patterns (e.g. the number of meals, quantities and types of food consumed for an average household), the strategies used in immediate response to food insufficiency, the short term response to surplus of resources, and the strategies used in the case of more extreme and prolonged shortage/surplus. Surplus is understood in this research as the surplus of money left when the minimum sufficient amount of food has been purchased.

The in-depth interviews never took longer than three quarters of an hour to an hour which was the limit acceptable for the interviewees. The interviews were carried out where the women lived, with the children around and the housework to be done. Thus it was difficult to have concentration for longer. During this process the women were very cooperative and found it interesting to talk about their food habits as was previously observed by Maxwell (1996).

#### **6.2.1.2 Focus groups**

Focus groups were used to rank the strategies identified in the in-depth interviews according to their perceived severity. Eight households were randomly selected in each community and the women in charge of these households were asked to participate in a focus group. Before organising the meeting, it was made sure that women from different ages and economic backgrounds would participate. A



‘reserve’ group was selected in case the some of the selected women refused to participate to the group.

The strategies identified during the in-depth interviews were written in large capital letters (red for the strategies related to shortages and green for surplus) in Swahili on large sheets of paper. Drawings were made if women did not know how to read. The focus group discussions would take about one hour and a half, they would be held in public meeting area (e.g. on the veranda of the village shop, or the veranda of the women’s association building). The atmosphere of these focus groups was as informal as possible so that the women felt at ease and the presence of a research assistant helped. Drinks and small snacks were passed around. Some of the younger women were often very nervous, not knowing what would be expected from them.

The strategies identified in the in-depth interviews were read aloud and the participants were asked if they agreed with these strategies and, if not, to take some out or add some others. The only change occurred in Wasini where the long term divestment strategy of selling “gold” or jewellery was introduced.

It was decided that the groups would score the strategies according their severity (see on scoring Chambers, 1989, Bernard, 1995, Mikkelsen, 1995, Slocum *et al.*, 1995) in order to solve the problem identified by Maxwell (1996) and assign cardinal values to the strategies’ severity rather than ordinal values (see section 6.1.3). Thus, the participants were distributed piles of 50 stones in order to assign to each strategy discussed an amount of stone equivalent to their perceived severity. When the strategies were all agreed upon, women were asked to score them. The greatest number of stones would represent the worst strategy, or the worst situation to be in. However, the scoring process failed. The women were shy, my assistant did not fully understand the process and my Swahili was not good enough to communicate the idea. It was thus decided to rank the strategies.

The ranking process was very successful as the shy women felt more at ease and participated. The way the strategies were ranked was by asking the groups the



sequence of strategies they would use in a situation of shortage or surplus. When the sequence was more or less agreed on, the strategies were read aloud to the groups in the order in which they had been ranked (sequence by sequence); from the least to the most severe for the responses to shortage and from the least positive to the best for the accumulation strategies. The participants were asked if they agreed with the sequence. For all the groups, discussions were lively as the women felt more confident to participate in the process and alterations were made. At the end, the results were read aloud again to make sure the women did not want to change anything. After the end of the meeting, informal discussions were carried out with the participants to talk about the process and what their feelings were about it.

#### 6.2.1.3 Questionnaire surveys

On the basis of the result of the interviews and focus groups, a questionnaire was designed. The questions were short and simple (see fig. 6.2). Because of the seasonality of the activities and of the climate, two rounds of surveys were planned (see chapter 3). In the study site the rainy season corresponds to the hunger period (Corbett, 1988, Nyborg and Haug, 1995, Maxwell, 1996) when the crops are not ready, the fishing conditions are hard, the tourism is at its lowest (private boat owners have less business). Moreover, the rains bring into the study sites the proliferation of mosquitoes, particularly the *Anopheles* which carry malaria. The conjunction of the hunger period, increase in malaria and hard conditions for fishing affects the household food security negatively. In contrast, in the dry season conditions improve (e.g. health, crops are harvested, the fishing conditions are less hard) and the household food security should improve. Similar observations were made in Kampala (Maxwell, 1996).

Following the simple random method with a table of random numbers, 50 households were selected in Kibuyuni, Mkwiro, Wasini and Anzwani (in Kichangani, all the households were surveyed) (see Bernard, 1995). Simple random sampling is not always appropriate (see section 4.1.3) but in this case it was decided to be the best option as the number of households selected represented from 35%



(Kibuyuni) to 100% (26 households in Kichangani) of the total households. This was considered to be large enough samples to get a representation of the different socio-economic profiles and activity groups (Bernard, 1995). The information gathered when listing the households with the village chairman enabled the representativity of the samples to be checked (e.g. percentage of fishers).

In reality, the number of households surveyed was less than 50 for most of the village due to the refusal of some households to participate. As already explained (see chapter 4), if informants refused to be interviewed, the next household on the list, with a similar activity and wealth, would be selected if possible. This was done in order to minimise the bias and ensuring that the sample was still representative. However, some people refused to answer because they were suspicious, uncomfortable or embarrassed and others were away or had moved. Thus, the number of informants surveyed in total was reduced (see table 7.9), however the percentage of households surveyed still varied between 29% and 100% of the total households in each village.

#### **6.2.1.4 Comments**

The strategies identified in the focus groups were ranked in order to determine a sequence which could be used in measuring the overall food security of the households. The ranks determined by the focus groups were used in the calculations of the indices was the median of the ranks obtained in the villages.

The median rank was considered to be appropriate for several reasons. Although some of the sequences differed (particularly for the strategies used in the longer term situations of crisis or surplus) (see appendix 5), the differences came mainly from the difference of the cultural backgrounds or from the difficulty to put into sequence some of the longer term strategies. For example, eating meat in the strict Muslim community of Wasini is a custom on Fridays (Muslim Holiday), in the other villages it is not so important. Thus, although buying meat reflects a certain surplus, in Wasini it can come earlier in the sequence than buying *lesos* (garment worn by



women on the coast). Moreover, in Wasini for example, households do not tend to have chickens (see chapter 7) which meant that selling a chicken was not a very used strategy.

In order to tackle this issue of rank difference, several sequences were tried and used in the calculations of the indices. One strategy was to use the village ranks and calculate the scores in each village with their own ranking, the second was to rank the strategies according to their frequency of use with the assumption that the more a strategy is used the less severe it is. It was found that although the scores differed significantly (ANOVA:  $p < 0.01$ ) according to the ranking used, the ranks of the households within their villages were not significantly affected by the change in the sequences (see appendix 5). The most appropriate ranking was considered to be the median of all the villages as it would integrate the cultural differences by making a compromise between the villages, smoothen the potential distortions due to misunderstanding and enable a comparison of the indices to be carried out.

When rankings and frequencies were chosen, a questionnaire was designed and the households were interviewed. Because people might have alternative motives (e.g. attract aid) when they accept to participate in a research (Bernard, 1995), they can exaggerate the acuteness of their situation. In this manner they would appear poorer and hence get more money. In order to reduce this phenomenon, when introducing the research at the village meetings (see chapter 4), it was made clear that this research was not a development project and that my contribution to the communities would not come through giving money. However, even though it happened rarely, some informants tried to exaggerate their situation, but it was often obvious. The risk of not detecting such bias was reduced in several ways (e.g. cross checking the questions, asking the questions in different ways) and by the presence of research assistants who knew the informants well (see chapter 4). The fact that some of the questions were repeated during the survey (i.e. some of the strategies were identified as long term and short term strategies) also contributed to minimise the risk of respondents' bias. Most often, if an informant were lying she would contradict herself during the interview.



## 6.2.2 Strategies identified

### 6.2.2.1 Household consumption patterns

The women prepare three meals a day, breakfast, lunch and dinner. Breakfast is usually composed of very sweet tea with milk (if available) and a loaf of white bread, *mahambre* (local doughnut) or *chapati* (flat breads). At lunch or dinner, *ugali* (maize meal cake), cassava or rice accompanied with fish (if available) is usually consumed. If fish is not available pulses are consumed to replace the protein intake. Tomatoes and onions are sometimes added to the fish. Cassava, beans, fish, rice are often cooked with home made coconut cream. Vitamins are obtained through the consumption of fruit such as mangoes or oranges which are grown on the mainland.

In Anzwani, most households grew fruit trees thus had free access to fruit and sometimes coconuts. In Kichangani some households cultivated rice which they sold or stored. In Kibuyuni, most of the households cultivated maize inter-planted with pulses. Household members attending the fields ate some of the young maize grilled on the cob. The remainder was left to dry on the stalk, harvested and then stored. Some of the households had up to five months reserves of maize. This meant, that, in case of food shortage, some maize could be taken to the mill to be ground and the households could eat their maize about two or three times a month for five months. On the island, very few households have access to land (see chapter 3). Thus, very little subsistence farming is carried out.

Although on the mainland, subsistence production contributes to the households' consumption, most of the households are highly dependent on the market. In the study sites, protein intake mainly comes from fish. Fishers bring home the fish and sell the surplus.

The interviewed women estimated that they spent between 150 and 250 Ksh on a daily basis.



**Table 6.1: Daily food consumption of an average household\***

Consumed daily	Quantity	Cost
<b>Water (on the island)</b>	3 jerricans	15 Ksh
<b>Breakfast</b>		
Tea	Few leaves	2 Ksh
Sugar	0.5kg	20 Ksh
Chapati	1kg of wheat flour	36.5 Ksh
<b>Lunch</b>		
Ugali	2kg	50 Ksh
Fish	0.5kg	20 Ksh (if bought)
<b>Dinner</b>		
Rice	1 kg	40Ksh
coconut	3	12Ksh
salt**		1Ksh

<b>Non Foods</b>		
Soap/Washing powder**	1bar/packet per week	5Ksh
Oil		3Ksh

*\* An average household was composed of 6 people, three adults and three children*

*\*\*The daily consumption of these products was worked out according to how long they took to be used and their retail price*

The consumption detailed (table 6.1) is the minimum that informants considered as sufficient. Most often the women bought food for two or three days at a time, very wealthy households would buy the basics (e.g. sugar, flour, tea, salt..) for 15 days. No fresh water is available on the island and households have to buy three to four jerricans per day on average (5 Ksh each).

The household budget detailed in table 6.1 enabled me to calculate the monthly amount of money necessary for households to have sufficient food and soap (basic needs). For example, an average fishing household in Anzwani (i.e. no dependence on the market for fish, free access to fresh water, free access to fruit in season) needs at least 4995 Ksh ( $166.5^{16} \times 30 = 4995$ ). If a household depends totally on the market, it needs at least ( $186.5 \times 30 = 5595$ ) 5595 Ksh per month to cover the basic needs. These figures do not cover cigarettes, clothes, school fees, maintenance of gear and

<sup>16</sup>  $166.5 = (\text{Breakfast: } +\text{Lunch } +\text{diner } +\text{soap})$ . To cover protein needs, fish is cheaper than pulses (26Ksh).



boat (if fishing household). The cost of accommodation is not taken into consideration as most of the households have built their huts and have no rent to pay.

It is important to know that a person employed by one of the tour operators earns on average between 5000 and 7000 Ksh (see chapter 9) per month and the basic salary of a civil servant reaches up to 7000 Ksh. It could explain why some fishing scouts might have to develop a side activity to survive (see chapter 5). If only one person contributes to the households' budget, there is very little margin for the household to cope if a crisis occurs. However, in most of the households more than one member has an activity and brings food or money to the household (on average 1.6, see chapter 7).

The high dependence on the market for food makes the households highly vulnerable to price fluctuations. Moreover, the track to Shimoni (the main market place for the study sites) has no tarmac and often becomes difficult to pass during the rains. This sometimes leads to an increase in the price of foodstuff delivered in Shimoni (see section 6.2.4.5).

#### **6.2.2.2 The strategies identified**

The household strategies identified by the informants during the in-depth interview process were similar in all the communities and were comparable to the ones discussed in previous studies (Corbett, 1988, Maxwell and Frankenberger, 1992, Davies, 1993, Maxwell, 1996) (see also section 6.1.2). They included for example changes in diet, sales of liquid assets, maternal buffering (e.g. a mother reducing her consumption to feed dependent children sufficiently). However, some of the strategies mentioned in other studies were not identified by the informants (Corbett, 1988, Maxwell and Frankenberger, 1992). For example, gathering wild foods was not mentioned. When asked, informants said that the wild foods were eaten by the wildlife. More extreme strategies, longer term and possibly adaptive strategies included divestment and investment strategies.



**Table 6.2: Identified coping and accumulation strategies**

Short term		Long term	
Coping	Accumulation	Divestment	Accumulation
.Buy less food .Skip meals .Cook porridge ( <i>uji</i> ), .Give priority to feeding small children .Borrow from family .Not eat .Borrow from shop	.Buy lot of food .Buy meat .Buy <i>leso</i> * .Saving at bank	.Sell a goat .Sell chicken .Sell clothes .Sell jewellery .Use savings .Borrow from family or friends .Borrow from a money lender	.Buy chickens .Buy goats .Save money .Buy houseware .Buy <i>leso</i> * .Buy building material .Buy things for business

\* *Leso* is a type of colourful cotton sarong worn by the women on the coast.

• **Strategies used in case of shortage of food**

*Reducing stock and consumption:* As mentioned in section 6.2.2.1, in most households, women buy food for two or three days at a time. The first and least severe strategies of all used by the households (see section 6.2.3) is to buy less food (e.g. food for one day rather than two). More severe but widely used by the households is to reduce consumption when there is a shortfall of resources. The households' consumption can be decreased in several ways. For example, the portions' sizes can be reduced for all the members of the household or for some members only. In the latter case, the most common strategy would be that the mother eats less in order to give sufficient food to her children (see Campbell, 1991, Maxwell, 1996). The households' consumption can also be reduced by skipping meals. The informants underlined that most people would rather skip a meal and be satisfied by the other meals than having smaller portions at all the meals. An option, more severe and least preferred of the ways of reducing consumption is to replace some meals by *uji* (porridge made with rice flour and water or milk). If the shortage of food is acute and no other solutions are available the household members will not eat for the whole day.

*Borrowing food:* In case of shortage, households would ask for credit at the village shop for a very short term. This strategy was widely used by the households. Food was also borrowed from the neighbours or family.



*Borrow money:* If the shortage of food is relatively short term the households tend to borrow food. If the shortage of food is more extreme, they are more likely to borrow money. The money is borrowed from the family (most usual even though disliked) or from a money lender. Borrowing money can increase a household's vulnerability as it can lead to a situation of long term indebtedness (Maxwell, 1996). These strategies are considered as most severe (see section 6.2.3)

*Sale of liquid assets:* In a short term shortage situation, very liquid assets such as chickens were sold. Although they could be eaten, by selling a chicken a household could get 80 to 100 Ksh (enough to have two full meals). Selling a chicken was not considered as a severe strategy.

*Divestment:* If the shortage of food lasts longer, liquid and less liquid assets can be sold. The more liquid the asset the less severe the strategy was considered to be by the households. Assets included chickens, goats (up to 4000 Ksh), *leso* (sarong type garment worn by the women), jewellery. These were the assets most often mentioned. Jewellery was often sold to pay for things such as school fees (from 600 Ksh per year in primary school to 12000 Ksh per year in secondary school) or to pay for medical care in case of serious illness.

It is important to make a distinction between households selling assets to cope with a crisis situation and households for which these strategies are part of their livelihood system (i.e. selling assets like goats or *leso* as a business). Using up bank savings was also mentioned by the informants even though few households had bank accounts as was realised later.

- **Accumulation strategies**

*Increase stock and consumption:* In the short term, the first strategy households would use is to buy more food stocks (e.g. buy for one week rather than two days). If the surplus is large, they would buy more luxurious foods such as meat. In Wasini most of the households ate meat regularly (e.g. on Fridays the Muslim holiday) but



in the other studied villages households would very seldom consume meat. Most of them would save in order to be able to buy meat for Ramadan.

*Increase assets:* In the case of a surplus households would build up first the liquid assets such as chickens or *leso*. Buying *leso* as a store value (approx. 200 Ksh each) is very common in Mkwiro. *Lesos* are a very important item during Ramadan as numerous parties, particularly weddings, are organised and women have to be dressed up differently for each of the parties. The longer and more extreme the surplus, the more substantial assets would be bought such as goats, houseware (including kitchenware, basic furniture). Saving the excess in the bank was also mentioned, again even though very few households had bank accounts.

*Investment:* If the surplus is substantial, investments are made. These include investment in an activity (e.g. build a little shop, buy a new dug out canoe etc.) but also investing in the house (e.g. by buying stones and cement). Most of the households live in mud huts, with a wooden structure and straw roofs. In Wasini however, a lot of houses are made of stones and cement or of concrete with corrugated iron or straw roofs. Numerous households would invest if possible in corrugated roofs (less maintenance, more resistance, and status). The type of house is one of the criteria used by informants to identify wealthy households. A corrugated iron roof can cost from about 20 000 Ksh in 1997/98.

Some of the strategies were identified as short and long term strategies. Mainly, they were the strategies used at the earlier stage of more extreme surplus or shortage. This confirmed the role of such strategies in the short term and helped in the triangulation and cross checking process discussed in section 6.3.

### **6.2.3 Ranking the strategies according to their perceived severity**

The identified strategies were ranked by the women focus groups in each community. In Wasini, Anzwani and Kibuyuni, several focus groups were organised,



they represented the sub-communities which composed the villages (see chapter 4). The severity ranks of these three villages are the median of the different groups' results. The strategies' severity presented in the following sections was calculated by taking the median of the five communities' rankings (see section 6.2.1.4).

**6.2.3.1 The short term strategies**

**Table 6.3: Severity ranking of the coping strategies**

Strategies	Rank
Less food	1
Sell chicken	2
Skip meal	3
Porridge	4
Feed only children	5
Credit at the shop	6
Borrow from family	7
No food for a day	8

All the groups agreed that buying less food was the first thing they do in case of shortage of money and that it was the least severe strategy as shown in table 6.3. As suggested in the in-depth interviews the groups would rather skip a meal than drink porridge or reduce the portion sizes, thus drinking porridge two meals out of three was perceived as more severe than skipping a meal. Selling chickens was not considered as a severe strategy (2) as they can be bought easily and multiply quickly.

The severity ranking of the short term coping strategies (table 6.3) reflects the will of the households to stay independent. For example, most of the groups in the villages preferred to get credit from the local shop rather than borrow from the family. However, family and community support played an important role in the study sites as observed in previous studies (Swift, 1989). All the groups found that the most severe strategy was not to eat for a whole day and they would try and avoid it. It often happened mainly if the household did not feel it could borrow food anymore.



**Table 6.4: Ranking of the accumulation strategies**

Strategies	Med. Rank
Buy more food	1
Buy <i>lesos</i>	2
Buy meat	3
Put money in the bank	4

The severity ranking of the short term accumulation strategies (table 6.4) have to be interpreted differently from the short term coping strategies' ranking. For example, rank 1 corresponds to the least positive strategy, reflecting a small surplus whilst, the strategy ranked 4 would represent the best situation for the households to be in. The first thing women would do if there is an excess is buy more food (three days rather than 2 days or 15 days). Meat would be purchased when all other foods were bought and used to make a rice dish called *pilau*. As it will be shown later, saving money in the bank was used regularly only in Wasini, the most “monetarised” village.

**6.2.3.2 Longer term strategies/more extreme strategies**

**Table 6.5. : Severity ranking of divestment strategies**

Strategies	Rank
Sell chicken	1
Sell goat	2
Use savings	3
Sell <i>leso</i>	4
Sell gold	5
Borrow from money lender	6
Borrow from family	7

As for the short term coping strategies, the severity ranking of the longer term strategies (table 6.5) shows the will of the households to depend on their own resources. However, by selling their assets they may increase their vulnerability and reduce their capacity to go back to a pre-crisis stage. Borrowing from family and money lenders were the worse perceived strategies because of the indebtedness it put the household in. Selling *lesos* is also considered as a severe strategy even though *leso* can be bought regularly. This is because *lesos* are bought by women with their



own money (e.g. from small side businesses) which is normally not used for household expenses. Small animals are bought often for business or as liquid assets, they are hence disposed off easily, they are used for food only in festivals. Selling jewellery was mentioned but used mainly in Wasini and mostly to pay school fees or the medical care for a sick child or other household member.

**Table 6.6: Ranking of the longer term accumulation/investment strategies**

Strategies	Rank
Buy chicken	1
Buy goat	2
Buy <i>leso</i>	3
Buy houseware	5
Put money in the bank	6
Buy building material	6
Invest in activity	8

The interpretation of the ranking of the longer term accumulation (table 6.6) is similar to the one of the short term accumulation. Rank 1 corresponds to the first thing that households would do and rank 7 the strategy used in case of extreme surplus. Household in the best situation will buy hardware and trade as they have satisfied all their basic needs and have accumulated enough assets to recover if a crisis occurs. Buy building material and save money in the bank came out as equivalent overall during the ranking process.

### 6.2.3.3 Frequencies

The frequency of use of the strategies on which the indices are based were weighted by Maxwell (1996). However, Maxwell (1996) found that one of the limiting factors of the food security index was the possible difference of interpretation of the frequency scale he used (i.e. never, rarely, sometimes, frequently). My choice was to ask the rough number of times strategies were used in the last few weeks for a short term strategy and in the last 5 to 10 years for the longer term strategies.



**Table 6.7: Frequency of use and weighting.**

Short term	WEIGHT			Long term	WEIGHT	
	Coping	Accum.			Divestment	Accum.
Every day	1	5		More than once a year	1	5
2-5 times a week	2	4		Once a year	2	4
1 to 2 a week	3	3		Two to four times	3	3
1 or 2 a month	4	2		Once	4	2
Never	5	1		Never	5	1

*Accum.: accumulation strategies*

The weight attributed to the frequencies varied according to the type of strategies (table 6.7). In terms of short term food coping strategies, households were in the best situation if they never have to use the strategies thus the weight decreases with the number of times the strategies are used. In contrast, the households are better off if they use the accumulation strategies often, thus the weight given to the frequency increases with the number of times strategies are used. The logic of the short term applies to the longer, more extreme accumulation and divestment strategies.

**6.2.4 Two rounds of surveys**

**6.2.4.1 The questionnaire**

The questionnaire (fig. 6.2) is a result of the in-depth interviews, the focus groups and the identified frequencies of use. It was divided into four parts; questions on the attributes of the household (e.g. size) were asked first, then short term strategies used and the frequency of use of the longer term strategies were examined. The questionnaire ended with questions on the evolution and background of the households’ economic activities. The whole questionnaire lasted about 25 minutes per household surveyed. The questions were asked in Swahili with the help of the research assistants.

*Figure 6.3: The Questionnaire*



### I. HOUSEHOLD ATTRIBUTES

How many people eat in the house every day, from the same pot?

Do you own the house?

Do you own a plot?

### II. STRATEGIES

During these days (since the maize has been planted up to now) do you :	How many times:
<ol style="list-style-type: none"> <li>1. buy less food than needed</li> <li>2. Skip a meal</li> <li>3. Eat porridge all day</li> <li>4. Feed only the children</li> <li>5. Sell a chicken (identify if it is a business)</li> <li>6. Ask relatives</li> <li>7. borrow food at the shop</li> <li>8. Not eat for a day</li> </ol> <p>These days have you:</p> <ol style="list-style-type: none"> <li>1. Bought stocks (have you got stocks in your house? for how long?)</li> <li>2. Bought clothes</li> <li>3. Cooked pilau</li> <li>4. Put money in the bank</li> </ol>	<p>Every day</p> <p>2 to 5 times per week</p> <p>1 to 2 times per week</p> <p>Less (once or twice per month)</p> <p>5. Never</p>

### III. LONGER TERM STRATEGIES

Within the last ten years (or within your married life if less than 10 years) have you:	How many times:
<ol style="list-style-type: none"> <li>1. Had to take money from your account because of problems</li> <li>2. Sold a goat</li> <li>3. Sold chickens</li> <li>4. Sold jewellery</li> <li>5. Asked relatives</li> <li>6. Sold your clothes</li> <li>7. Borrow money /money lender</li> </ol> <ol style="list-style-type: none"> <li>1. Bought clothes</li> <li>2. Bought goats</li> <li>3. Bought chickens</li> <li>4. Bought furniture</li> <li>5. Put money in the account</li> <li>6. Bought building material</li> <li>7. Bought a canoe/business</li> </ol>	<p>More than once a year</p> <p>Once a year</p> <p>two to four times</p> <p>Once</p> <p>Never</p>

### III. BACKGROUND INFORMATION

What is your husband's work? Has he always done the same work? If not which work was he doing before?

If he is a fisher what gear does he use? Always? Does he have his own boat? For how long has he had it?

Have you got any children working? If yes what are they doing?

Are you cultivating?

Figure 6.2: The Questionnaire



210 households were interviewed in a first round of survey, when the situation of the households is at its worst in terms of food security (see chapter 3, and section 6.2.1.3). A second round of survey was carried out in order to investigate if a change could be observed in the use of short term strategies between the seasons. The questionnaire in the second round took only 5 to 10 minutes. The second round also enabled me to complement the information gathered in the first round of survey about the background and attributes of the households when necessary (e.g. cross check some of the information, ask some questions again when it was felt that some information could be more precise). However, due to ‘extraordinary’ climatic and political conditions, only 146 households could be surveyed and the seasonal pattern of activities was disrupted as discussed in section 6.2.4.3.

#### 6.2.4.2 Comments

The perception of time can be very subjective and vary between the informants and researcher (See Chambers 1989, Bernard, 1995, Slocum *et al.*, 1995). In order to avoid any misunderstanding, the way time was referred to in the study site was investigated during informal discussions. Thus, for the short term, the most appropriate references were decided to be “these days/ this season, this week, since the maize has been planted”. Two of the ways of expressing time were always used in conjunction with each other in order to ensure the interviewee and I had the same understanding of the time scale referred to. For the longer term strategies “in the last years, as long as you can remember, and as long as you have been married (for the younger married couples)” were used. This referred to the last 10-15 years, which was the scale I was interested in. To make sure, when an informant mentioned having used a divestment or investment strategy (selling or buying hardware for example) she was asked which year it happened.

The number of times a frequently used strategy was used could be remembered precisely up to 10-15 days. When informants said they used a strategy, the frequency was cross checked by asking the informant to confirm when they used it last. For example if an informant answered, “we borrow often”, I would ask more details and



work backwards: “when have you done that last? Yesterday? The day before?”. By asking for precision on the frequency of use of strategies a lot of information was confirmed and rectified without adding too much time to the duration of the interview.

As mentioned previously (section 6.2.2.2) a distinction had to be made between households using a strategy in order to cope with a situation and households having a side business (e.g. selling chickens, goats or *leso*). When it seemed that a strategy was used often, the women were asked if it was a business. If it was, the strategy was considered as never being used. In addition, a distinction had to be made between the coping strategy of borrowing food at the shop and households who kept a tab (i.e. paying once or twice a month). This latter situation occurred when wealthier households had regular incomes and it was not considered as a coping strategy. If the women interviewed said they borrowed at the shop often they were asked if they had a tab or not. If they did, the frequency of use was considered to be ‘never’ as it is then a part of their livelihood system rather than a coping strategy.

Both cases, (presence of a side business or presence of a monthly tab) were easy to detect as the informants would mention that they used these strategies every day or so which rose the question of whether it was a coping strategy.

#### **6.2.4.3 The second round of survey**

The realisation of the second round of survey was constrained by the season (it needed to be carried out between October and March, in the NE monsoon), by my scheduled return (beginning of February), by the presidential elections of the end of December 1997 and by Ramadan which started on the 19th December 1998 and finished on the 16th January 1999. The presidential elections were a constraint in the sense that political unrest was predicted to happen during the campaign (it could be unsafe for me to travel) as civil unrest had already happened in the middle of August where more than 100 people on the Coast had been killed. Although this unrest had



all the appearances of a tribal war, (coastal people against upcountry people), a political background was not excluded (see EIU, 1998).

Ramadan is a Muslim celebration during which people can only eat after the sunset and before the sunrise. At nights parties are organised, and during this period, on the Coast, numerous weddings are celebrated. As people fast during the day time and feast at night, doing the second round of survey at that time would have made it impossible to compare the two rounds. Furthermore, it would have been very difficult to interview women as they were always busy preparing festive meals and visiting friends. This reduced the time available to carry out the second round of interviews. However, understanding the importance of Ramadan was essential to interpret some of the results obtained through the interviews.

For the second round of survey to start it was important that the NE monsoon was established so that the seasonality would show (e.g. better fishing conditions, increase in tourism). The NE monsoon usually comes between the end of September and mid October. However in 1997, the change occurred very late in October beginning of November. Moreover, as a result of El Niño phenomenon, torrential rains hit the Kenyan Coast on the 18th of October (17 inches fell in 24h) (see fig. 6.3).

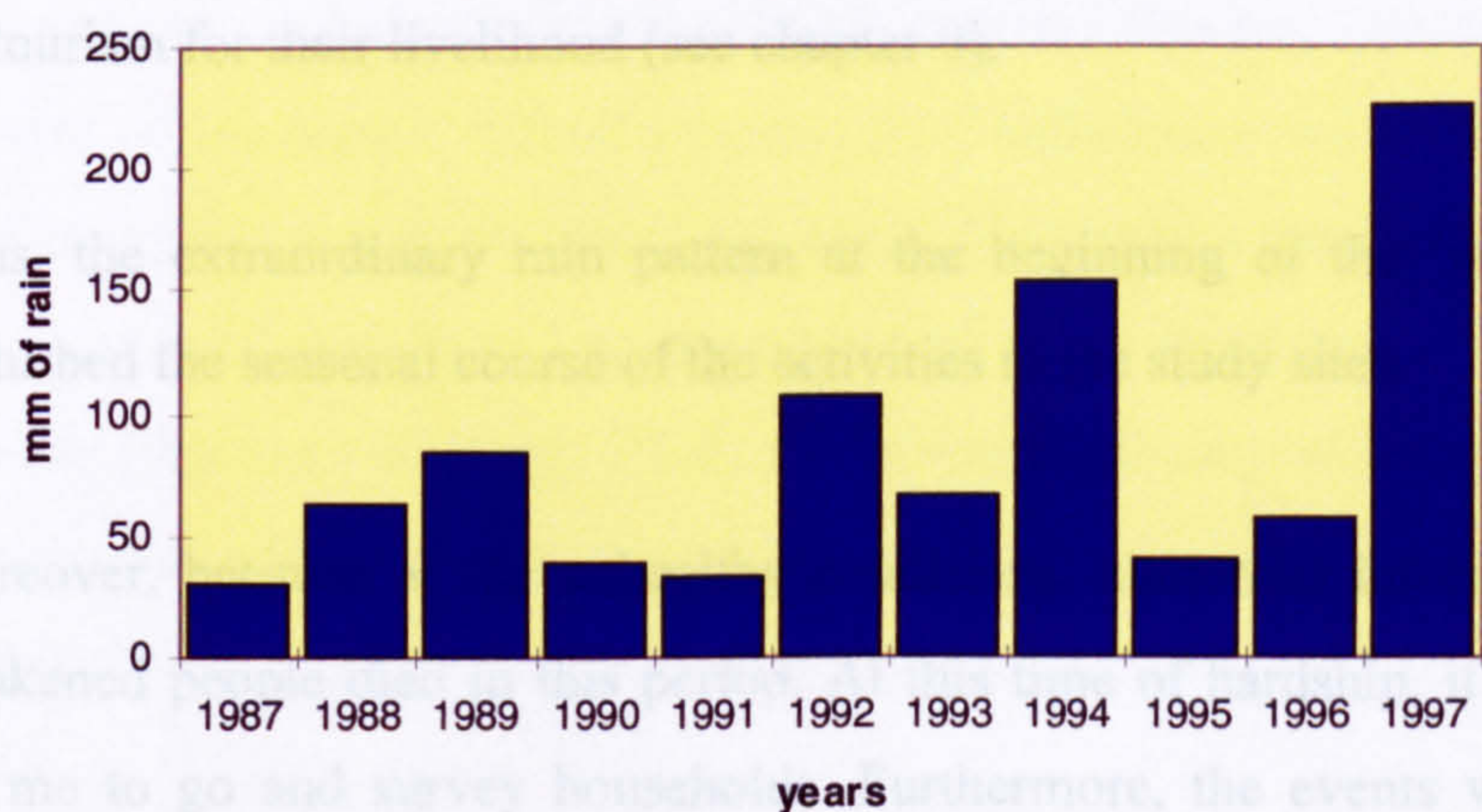


Figure 6.3: average millimetres of rain between September and December for 1987 to 1997 (*source: Shimoni residents*).



This rain caused the flooding of numerous parts of Kenya and destroyed the main roads. The main road going to the turn off to Shimoni was washed away in four parts. It was impossible to go by road to the study sites for 6 weeks, which again reduced unexpectedly the time available for the second round of interviews. At that time food shortages hit the study sites as products could not reach the sites and when they were available, their prices had increased sometimes by half. Thus the coast was declared in a state of emergency and food relief (maize) was distributed to the households by boat.

The rains affected the sites' infrastructures and increased the vulnerability of the households in several ways. Because the monsoon changed so late, the fishing conditions were hard for longer, the second crop (pulses) was ruined, the poorer households were then vulnerable. Moreover, the rains increased the period of high malaria risk but also worsened the hygiene conditions in the studied villages. This contributed to the start of an epidemic of cholera.

All these factors had a snowball effect and acted as a deterrent for tourism which stayed at its lowest until the elections had passed (see chapter 9). The succession of events starting with first the political troubles of August 1997, followed by the bad weather, the collapse of the infrastructure and health risks deterred the tourists. This increased the vulnerability of the households of the study sites who were depending on tourism for their livelihood (see chapter 9).

Thus, the extraordinary rain pattern at the beginning of the 'normal' dry season perturbed the seasonal course of the activities in the study sites.

Moreover, because of the unhealthy conditions, numerous informants were ill and weakened people died in this period. At this time of hardship, it was inappropriate for me to go and survey households. Furthermore, the events would have biased strongly the results of the second rounds. Thus I waited until people recovered and for the weather changed. Interviews were carried out at the beginning of December and some after Ramadan. However, because of the time constraint, a lot of the



interviews were carried out by the research assistants alone, particularly in Anzwani which had not occurred in the first round. Although the assistants had accompanied me during the first round of interviews and were observed doing their first interviews, this might have introduced a researcher bias.

Finally because of the lack of time and the difficulty of getting to Kibuyuni and the fact that my research assistant had left between the two rounds of survey meant that only 8 interviews could be successfully carried out in Kibuyuni. Thus, there were too few results to be able to compare the two rounds of survey for Kibuyuni.

For all the above reasons, most of the analysis was carried out for the first round of survey. The comparable results of the second and first round of surveys will be analysed but caution must be taken in the interpretation and the reliability of these results.

## **6.3 CONCLUSION**

Food security, as understood in recent years, includes elements of food sufficiency, access, vulnerability or security of the households and sustainability. Numerous indicators are available to measure food security. However, most of them only take account of one aspect of food security, food sufficiency. Recently, access indicators such as coping strategies have been used. They reflect food sufficiency as well as access to food and have become more and more important in the study of food security (Nyborg and Haug, 1995). If defined cautiously with a distinction between coping and adaptive strategies, food coping strategies can be a very useful to measure food security and give information on households' vulnerability (Maxwell, 1996).

Food security is a comprehensive way of assessing the vulnerability and the situation of households. In order to investigate the effects of the Kisite Marine National Park



on the surrounding fishing communities, it was decided that indices based on food coping strategies would be used. This would allow a comparison of the socio-economic situation of the selected communities to be made as it has been pioneered previously by Maxwell (1996).

Food coping strategies, accumulation, divestment and investment strategies are often location specific. In order to design appropriate indices, the strategies and their perceived severity used in the study sites were explored. The detailed description of the strategies and their severity in the context of the study sites given in this chapter is essential to have a wider understanding of the results and their analysis presented in chapter 7.



## **7 Analysis of the food security status of five selected villages**

On the basis of the questionnaire described in chapter 6, short term and long term scores were calculated to measure and compare the socio-economic status of the five selected villages. In this chapter, the results of the surveys are presented and analysed. The variability of the scores across and within the villages is examined, and the causes for this variability are investigated. Furthermore, information about the strength of the indices is presented at the end of this chapter.

### **7.1 METHODS**

Because of the nature of the data collected, the question of whether to use parametric (severity rankings) or non-parametric tests to analyse the results arose. This problem is discussed in the first part of this section and both parametric and non-parametric analytical tools are described. The Systat<sup>®</sup> 7.0.1 software was used to analyse the data and carrying out parametric and non-parametric tests.

#### **7.1.1 Analytical tools**

##### **7.1.1.1 The use of parametric statistics**

Two main problems identified could have prevented the use of parametric statistics to analyse the indices. The first one concerned the continuity of the data and the second one, the potential lack of symmetry (or approximate normality). However, from discussions with statisticians it emerged that parametric tests could be carried out. First, the continuity was not considered to be an issue as the way the indices were calculated (Severity\*Frequency) enabled the scores to take numerous values



between the maximum and minimum. In addition, parametric tests such as ANOVA and the t-test are based on means which smoothens the data (Clarke and Warwick, 1994). The size of the sample was sufficient to assume approximate normality as it included 210 households.

The main problem which could occur could be a large differences in the standard deviations between the compared groups (i.e. villages) as some tests such as the ANOVA or paired sample t-test rely on the assumption of constant variance across the groups (Clarke and Warwick, 1994). This did not occur across villages or across compared groups. However, if in doubt, non-parametric tests were carried out.

The main tests carried out on the scores were ANOVA and t-tests. Analyses of Variance were used when investigating differences in short and long term scores across different groups (i.e. across villages or groups within villages). To compare results of the two rounds of survey for each group, a paired sample t-test was used. The paired sample t-test is often used when two dependent samples need to be compared for example, in the case of a before and after experiments when testing new drugs (Argyrous, 1997). The results of the first and second round of surveys were thus treated as a pre-test, post- test design.

Demographic, economic or geographic parameters were identified on the basis that they might have an influence on the scores. The data were aggregated into quartiles for each village (see section 7.1.2). The potential links between the variables and the scores were investigated by using a shotgun approach (as described by Bernard, 1995). The Pearson correlation coefficient is considered as an appropriate measure when more than one of the variables are measured at the interval/ratio level which was the case. The significance of the correlations depends on the sample size (Bernard, 1995, Argyrous, 1997) and it was tested using the following formula (Argyrous, 1997:379):

$$(1) \quad t_{\text{sample}} = r \sqrt{(N-2)/(1-r^2)}.$$

N: sample size, r: correlation coefficient.



To identify the significant correlations in the shotgun matrix, critical coefficients were calculated by varying  $r$  until  $t_{\text{sample}}$  was equal to the  $t$  for 5% significance (1). The size of the samples used was mainly  $n=30$  or  $n=25$  (when dealing with the second round of survey). The critical correlation coefficients are presented in table 7.1.

**Table 7.1: Critical correlation coefficient above which significance is likely**

N	Alpha	$r_{\text{critic.}}$
5	$\alpha=0.05$	0.79
25	$\alpha=0.05$	0.396
30	$\alpha=0.05$	0.361

All coefficients larger or equal to the critical coefficient are considered significant. However, two main drawbacks of the shotgun approach have been identified (Bernard, 1995). The correlations in a matrix can be a result of chance. For example, at a  $\alpha=0.05$ , 5% of the results are expected to give a false positive (1 result in 20). Thus statistically significant but erroneous correlations can be found (Bernard, 1995). In order to minimise the risk of confusing statistically significant rather than substantively significant correlations, they were interpreted very cautiously.

### 7.1.1.2 The use of the non-parametric statistics

One of the ways to confirm that the use of parametric tests is justified is to compare the results of these tests to the results of non-parametric tests. If the results are very different, non-parametric test should be used, if not, it shows that the parametric test can be used. If in doubt, the non-parametric tests should prevail as they do not make such stringent assumptions.

Thus a Kruskal-Wallis one way analysis of variance was carried out to investigate the variability across villages and within villages (Argyrous, 1997). In addition, to investigate the differences between the two rounds of survey, households of each community were ranked according to their scores (from less to more food secure) and these ranks were compared. The aim was to see whether a pattern could be



detected in the difference of the scores and, if any, if it was applied to all households or only to specific groups of households. To do this, a non-parametric test was needed (i.e. the values were ordinal) and the Wilcoxon signed-rank test was considered to be the most appropriate test to compare dependent samples (Argyrous, 1997).

#### **7.1.1.3 Strength of the indices**

It was thought important to compare the discriminatory powers of the households food security indices used (their strength) as well as analysing the results of the surveys. To attempt and measure the strength of these indices, it was decided to calculate a score based on the amount of information each index provided on the households' attributes. In other words, significant correlations detected between the indices and identified parameters were given a score according to their strength. The indices' strength scores in relation to the study of the overall household sample are presented in table 7.26.

### **7.1.2 Division of the communities into food security groups**

#### **7.1.2.1 Wealth ranking process**

It was first decided to use wealth ranking to divide each studied community into wealth groups. Qualitative groupings have the advantage of being a relatively “objective” control for the results (Maxwell, 1996). To carry out the wealth ranking process, 50 households were randomly selected in each village (26 out of 26 in Kichangani) and the name of the “head” of each household (usually a man) was then written on cards. Three informants per village (men and women) were selected with the help of the village chairmen. These informants were chosen on the basis that they knew the community very well and its history, so were middle-aged to old people.

Individually, the informants had to sort out the cards into groups of similar wealth following the process described by Mikkelsen (1995) and Slocum *et al.* (1995).



When the cards were sorted, each informant was asked to describe the characteristics of each group and the reason for the difference in perceived wealth. Each household would get an average score in relation to the number of wealth groups identified by the informant and to the number of cards sorted (2).

$$(2) \quad \text{Average score}_j = \sum_{i=1 \text{ to } n} (r/R)_i * N_i$$

For each household (j); i: informants, r: individual rank of the groups in which the household was sorted (e.g. if there are five groups of cards ranked from the wealthiest to the poorest group, r=1 is the rank which corresponds to the wealthiest households), R: total number of groups or ranks, N: total number of households (cards) sorted.

Problems occurred and the process failed in several ways. First, it was very difficult to get women to carry out the process. Two women sorted the cards from two different villages but it was not successful. They were reluctant to talk about other households and, as is the case for most women of the middle aged generation in the study sites, they did not read fluently. This is not an intrinsic problem but because the cards had to be read aloud, it made the process difficult, long and tedious for the informants who were then reluctant to carry on to the end.

Secondly, the aim of the process was often not well understood and I had difficulties in explaining well enough the aim of the exercise without influencing the informants. Thus, in most cases the cards were sorted into family or activity groups rather than wealth groups. Furthermore, in the communities some names are common and appeared several times on the cards. Even though nicknames were added to distinguish the households, confusions occurred and it was difficult to ensure who was who after the informants had sorted the cards. The results for the same villages varied too much (e.g. the same household could be in the wealthiest or in the poorest group depending on the informant) to be compared. Because of the unreliability of the results were not used.



However, even though the process failed and the community was divided differently, the discussions with some of the informants during the wealth ranking exercise gave some information on how the informants perceived wealth or poverty. For example, the type of house, the number of wives, or of families supported by a household could give an indication of a household's economic situation. This information was used to cross check some of the information gathered during the household surveys.

#### **7.1.2.2 Division into quartiles**

Because the wealth ranking procedure was not successful, it was decided to divide the communities according to a short term food security (average of the Short Term Accumulation Index and a Food Coping Strategy Index, see chapter 6). The division was quantitative and assumed that the short term food security scores were a good measure of the socio-economic status of the households. The average of the short term scores was preferred to a grouping based on a single score or on an overall average (short and long term scores) for several reasons.

First, although the food coping strategy index had been tested and proved to be a good indicator of food security (Maxwell, 1996), it was thought that in some of the villages the short term accumulation index complemented the information and enabled further differentiation of the households. This was particularly important in the case of very low or very high food coping capacity. Thus using an average of scores was thought to be a more balanced way to group the households.

However, the average did not include the long term scores. Long term scores are based on strategies which can be or become adaptive as opposed to coping strategies (see chapter 6). They represent a different aspect of the situation of the household, it is thus important to treat the short and long term separately (Maxwell, 1996). Finally, it was thought that the short term strategies were easier to cross check than the long term ones (strategies used a long time ago) and their frequency of use was described much more precisely. The short term indices were considered to be more



precise and perhaps more reliable than the long term ones. Thus, the communities were divided into quartiles based on the average of the short term scores.

This quantitative division is a continuous division and is based on internal criteria rather than external ones, which makes it less reliable than a qualitative division. However, it has been used successfully by Haddad *et al.* (1994).

The matrix on which the shotgun approach was based was composed of four quartiles and the average for each community, four quartiles and the average for the whole population. All the parameters identified as potentially explaining the variability in the scores were aggregated and averaged at the quartile and community levels (see matrix in appendix 6).

## **7.2 RESULTS OF THE SURVEYS**

### **7.2.1 The scores**

To calculate the cumulative index for each household, the frequency scale was multiplied by the weighting factor based on the severity ranking (see the description in chapter 6).

#### **7.2.1.1 Calculations and first results**

Based on the results of the surveys, a Food Coping Strategy Index (FCSI) and a Short Term Accumulation Index (STAI) were calculated for both seasons. In the same way a Long Term Accumulation Index (LTAI) and a Long Term Divestment Index (LTDI) were calculated for each household. They were calculated by weighting the frequency (F) of use by the severity rank (SR) of each strategy for each household:



(3) 
$$I = \sum_{i=1 \text{ to } n} F(x_i)SR(x_i)$$

With I: index (FCSI, STAI, LTAI, LTDI), x: strategy, i: strategy number, SR: severity ranking, F: frequency of use of the strategy.

The higher the indices the more food secure the household. The scores were averaged for all the communities (table 7.2).

**Table 7. 2: Food security scores averaged at the community level**

Communities	FCSI	STAI	FCSI2*	STAI2*	LTAI	LTDI
Wasini	160.50	14.11	166.54	14.38	59.71	131.11
Kichangani	136.12	11.33	141.50	11.5	60	111.08
Anzwani	142.19	11.72	169.87	13.69	54.70	106.09
Mkwiro	149.56	13.66	161.16	13.33	69.33	114.65
Kibuyuni	145.71	12.63	-	-	56.38	124.45
All	147.89	12.82	162.00	13.41	60.23	117.92

*\*The number 2 refers to the second round of survey but due to special conditions too few households in Kibuyuni were sampled in the second round to analyse the results (see Chapter 6).*

In order to investigate the difference between the scores presented in table 7.2, an analysis of variance was carried out. A Kruskal-Wallis one way analysis of variance was also carried out.

**Table 7.3: Differences in the food security scores across communities**

Scores	ANOVA		Kruskal-Wallis	
	F	p	K-W	p
FCSI N=210	7.43	p<0.01	30.84	p<0.01
FSCI2 N=146	18.43	p<0.01	37.895	p<0.01
STAI N=210	4.82	p<0.01	21.706	p<0.01
STAI2 N=146	3.96	p<0.01	13.725	p<0.05
LTDI N=203	14.57	p<0.01	54.881	p<0.01
LTAI N=203	5.33	p<0.01	20.077	p<0.01

As shown by the table 7.3, the short term and long term scores varied significantly (p<0.01) according to the village. The ANOVA and the Kruskal-Wallis tests produced similar results which was further confirmation that the parametric tests could be used to the analyse the collected data. So, to compare the food security situation of the villages, the communities were ranked according to their average scores.



**Table 7.4: Communities ranked according to their average food security scores\***

Communities	FCSI	STAI	Med1	LTAI	LTDI	Med2	FCSI2	STAI2	Med3
Wasini	1	1	1	3	1	2	2	1	1.5
Kichangani	5	4	4.5	2	4	3	4	2	3
Anzwani	4	5	4.5	5	5	5	1	4	2
Mkwiro	2	2	2	1	3	2	3	3	3
Kibuyuni	3	3	3	4	2	3	-	-	

*\*1: best off, 5: worse off.*

*Med1: Median rank for the short term in the first round, Med2: Median rank for the long term, Med3: median rank for the short term in the second round*

Tables 7.2 and 7.4 show that in terms of the use of coping strategies in the first round (FCSI), Wasini and Mkwiro are the better off whereas Kichangani and Anzwani are the worse off. This changed slightly in the second round, as although Kichangani stayed the worse off, Anzwani became better off on average than Wasini. In terms of accumulation, a similar pattern to the one of the coping strategies is detected in the first round with Wasini's and Mkwiro's accumulation capacities better than the other communities whilst Kichangani's and Anzwani's are the worse off. In the second round, the order changes, although Wasini stays in the lead in terms of accumulation, Kichangani becomes second but Anzwani stays worse off.

In the longer term, Anzwani is the worse off both in terms of divestment and in terms of accumulation. Wasini is the best off in terms of divestment but Mkwiro households are the best off in terms of accumulation in the long term interestingly followed by Kichangani. There is some variability.

On average, the households of Wasini and Mkwiro are more food secure in the short term (first round) as well as in the long term than the other communities. The difference between the second and first round is examined in the following section.

### **7.2.1.2 Difference between the two rounds of survey**

A paired sample t-test was carried out to compare the scores between the two rounds of survey. Furthermore, in order to detect whether patterns of change had affected certain groups of households rather than others, the households were ranked according to their scores and the difference of ranks was investigated with a



Wilcoxon signed rank test (Argyrous, 1997). The ranks corresponding to the two rounds were treated as dependent samples.

**Table 7.5: Comparison between the two rounds of households' surveys**

Test	Paired samples t-test				Wilcoxon signed rank test			
Scores	FCSI/FCSI2		STAI/STAI2		FCSI/FCSI2		STAI/STAI2	
Community	t	p	t	p	z	p	z	p
Wasini N=34/33	1.15	NS	0.13	NS	2.83	p<0.01	2.52	p<0.05
Kichangani N=22	1.44	NS	0.09	NS	1.23	NS	1.34	NS
Anzwani N=45	8.39	p<0.01	4.81	p<0.01	0.38	NS	0.43	NS
Mkwiro N=45	4.97	p<0.01	-0.553	NS	0.30	NS	0.47	NS

The results presented in table 7.5 show that the there are no significant differences between the two rounds on average in Wasini and Kichangani and no significant difference is detected in Mkwiro in terms of the STAI ( $p>0.05$ ). However, the results of the t-test enabled to say that in Anzwani and Mkwiro households had significantly increased their food security in the short term (significant increase of the FCSI). Moreover, in Anzwani, the households are significantly better off in terms of short term accumulation as well.

The Wilcoxon signed rank test shows that although there was no changes in terms of the scores between the two rounds of survey in Wasini, the ranks of the households within the village changed significantly. In the other communities no such observation could be made. This suggests that, in Wasini, between the first and second round of survey, some households have become better off in the short term than others. This might be related to their activities and will be investigated further in the following sections.



## 7.2.2 Variations within communities

### 7.2.2.1 The short term food security

The population of each community was divided in quartiles. The groups correspond to four levels of short term food security: Very Low (VL), Medium Low (ML), Medium High (MH) and High (H). With these divisions, it was possible to investigate the variability of the groups' scores between communities. The average short term scores for the groups in each community are presented in table 7.6 and table 7.7.

**Table 7.6: FCSI scores controlling for short term food security**

Groups	Round	Wasini	Kichangani	Anzwani	Mkwiro	Kibuyuni	All
VL	1st	132.25	114	113.5	122.92	121.58	119.06
	2nd	158.111	128.143	167.455	150.1	-	149.97
LM	1st	156.3	129.667	134.0	146.75	138.89	140.96
	2nd	164.83	140.75	170.5	162.91	-	162.46
MH	1st	172.7	138.167	149.46	158.25	156.8	158.41
	2nd	169.812	144.2	169.923	164.4	-	166.45
H	1st	180.0	162	169.83	170.769	169.7	173.6
	2nd	171.22	155.33	171.64	167.917	-	169.64
All	1st	160.5	136.12	142.19	149.56	145.71	147.89
	2nd	166.54	141.57	169.87	161.6	-	162

**Table 7. 7: STAI scores controlling for short term food security**

Groups*	Round	Wasini	Kichangani	Anzwani	Mkwiro	Kibuyuni	All
VL	1st	12.83	12.29	10.42	10.61	10.58	10.87
	2nd	12.22	11	13.64	10.92	-	12.05
LM	1st	12.05	10.83	11.17	11.25	15.94	12.26
	2nd	14.33	11.25	13.4	12.73	-	12.18
MH	1st	14.75	10.75	12.3	15	12.05	12.67
	2nd	13.75	11	12.9	13	-	13.68
H	1st	16.58	11.29	12.87	17.69	12.7	15.55
	2nd	17.1	12.67	14.91	16.58	-	15.82
All	1st	14.11	11.33	11.72	13.66	12.63	12.82
	2nd	14.38	11.5	13.69	13.33	-	13.41

In order to compare the scores of each identified group between villages an ANOVA and a Kruskal-Wallis one way analysis of variance were carried out.



**Table 7.8: Differences in the groups’ food security scores across villages (FCSI and FCSI2)**

FCSI					FCSI2				
Group	F	p	KW	p	Group	F	p	KW	p
VL N=56	3.83	p<0.01	18.31	p<0.01	VL N=39	7.03	p<0.01	14.37	p<0.01
LM N=47	33.21	p<0.01	34.39	p<0.01	LM N=31	5.49	p<0.01	7.89	p<0.05
MH N=51	40.93	p<0.01	37.66	p<0.01	MH N=36	5.53	p<0.01	10.52	p<0.02
H N=54	13.65	p<0.01	28.93	p<0.01	H N=39	2.33	NS	6.91	NS

The results of both tests are similar (table 7.8). The analysis of variance shows that, controlling for short term food security, the groups’ scores varied between communities. In order to make it easier to compare, the scores of each groups were ranked.

**Table 7. 9.: Groups ranked according to the FCSI and FCSI2 for each village**

Village	FCSI				FCSI2		
	VL	LM	MH	H	VL	LM	MH
Wasini	1	1	1	1	2	2	1
Kichangani	4	4	5	5	4	4	4
Anzwani	5	5	4	4	1	1	2
Mkwiro	2	2	2	2	3	3	3
Kibuyuni	3	3	3	3	-	-	-

*1: better off, 5: worse off*

Table 7.9 shows that, when comparing the group’s scores, Wasini’s and Mkwiro’s households were better off in the first round than the groups in the other villages. Contrarily, the groups in Kichangani and Anzwani are worse off than the other communities. This confirms the results obtained at the aggregated levels and shows homogeneity in the levels of food security of the villages in relation to each other.

In the second round of surveys, as observed in the analysis of the data at the village level, the ranks vary. For the three groups where significant differences could be detected across villages, Wasini and Anzwani are better off. Kichangani stays the worse off. The leading position of Anzwani might be explained by a change in the



season. However, the change in the groups’ situation could also be due to the change in the researcher (see chapter 6).

**Table 7.10.: Differences in the groups’ food security scores across villages (STAI and STAI2)**

STAI					STAI2				
Group	F	p	KW	p	Group	F	p	KW	p
VL N=56	2.61	p<0.05	8.61	NS	VL N=39	2.87	p=0.05	13.96	p<0.01
LM N=47	3.77	p<0.05	8.26	NS	LM N=31	1.14	NS	3.27	NS
MH N=51	3.85	p<0.01	15.93	p<0.01	MH N=36	1.4	NS	4.38	NS
H N=54	7.65	p<0.01	21.33	p<0.01	H N=39	2.43	NS	7.9	p<0.05

As shown in table 7.10, the results of the parametric and non-parametric tests vary slightly for both rounds. The reason for this could be the lower power of non-parametric tests to detect significant differences as they don’t make such stringent assumption. However, in doubt, the results of the non-parametric test will be used.

**Table 7.11.: Short term food security groups ranked according to the STAI and STAI2 in each village**

Village/groups	STAI		STAI2	
	MH	H	VL	H
Wasini	2	2	2	1
Kichangani	5	5	3	4
Anzwani	3	3	1	2
Mkwiro	1	1	4	3
Kibuyuni	4	4	-	-

*1: better off, 5: worse off*

Table 7.11 summarises the results by ranking the villages according to the groups’ scores. The ranks show that Mkwiro and Wasini households belonging to the medium high (MH) and the high (H) short term food security groups have more accumulation capacities than households in other villages (in the first round). Again, both groups in Kichangani are the worse off followed by Kibuyuni and Anzwani.

As for the first round, only two groups in the second round showed significant differences across the villages. The order is changed and Anzwani’s VL group is the



best off followed by Wasini’s. In the group of the more food secure, Wasini is better off followed by Anzwani.

7.2.2.2 Variability within communities of the long term indices

The long term indices of the groups were also examined in order to see how communities varied in terms of long term security.

Table 7.12: LTDI controlling for short term security

Groups	Wasini	Kichangani	Anzwani	Mkwiro	Kibuyuni	All
VL	119.08	96.14	99.58	104.15	115.25	105.38
LM	130.6	112.33	100.78	110.45	118.89	114.06
MH	135.2	116	116.18	116.17	132	122.17
H	139.4	120.71	107.33	128.33	133.89	130.35
All	131.11	111.08	106.09	114.65	124.45	117.92

Table 7.13: LTAI controlling for short term food security

Groups*	Wasini	Kichangani	Anzwani	Mkwiro	Kibuyuni	All
VL	53.09	62.43	47.33	63.85	49.33	55.02
LM	56.3	48.93	52.4	67.82	60.37	55.34
MH	63.2	55.17	54.38	61.33	62	61.08
H	65.7	71.29	64.33	64.67	56	70.3
All	59.71	60	64.7	69.33	56.38	60.23

The differences of the long term scores between the groups across villages were investigated.

Table 7.14 : Differences in the groups’ food security scores across villages (LTDI and LTAI)

LTDI					LTAI				
Group	F	p	KW	p	Group	F	p	KW	p
VL N=56	2.81	p<0.05	12.22	p<0.05	VL N=55	4.39	p<0.01	13.04	p<0.01
LM N=45	3.91	p<0.01	11.50	p<0.05	LM N=45	1.71	NS	6.44	NS
MH N=48	4.56	p<0.01	15.30	p<0.01	MH N=50	0.57	NS	4.32	NS
H N=52	12.68	p<0.01	32.42	p<0.01	H N=50	4.16	p<0.01	15.98	p<0.01



The results of the Kruskal-Wallis one way analysis of variance and of the ANOVA presented in table 7.14 are similar. The long term divestment (LTDI) scores are significantly different according to the villages for all the groups. However, for the long term accumulation scores, only the least and most food secure group in the short term vary significantly across communities. Table 7.15 summarises the results and presents the ranks of the villages according to their groups' scores.

**Table 7. 15: Groups ranked according to the LTDI and LTAI for each village**

	LTDI				LTAI	
Village	VL	LM	MH	H	VL	H
Wasini	1	1	1	1	3	2
Kichangani	5	3	5	4	2	1
Anzwani	4	4	3	5	5	4
Mkwiro	3	5	4	3	1	3
Kibuyuni	2	2	2	2	4	5

In terms of long term divestment all groups in Wasini and Kibuyuni are better off than the others. Except for the low medium short term food security group, the scores of Kichangani's groups are the worse or nearly worse off. Similarly, all the Anzwani's groups except for the MH are in the lower LTDI scores.

However both Kichangani's VL and the H groups are in the better off in terms of long term accumulation (LTAI). Kibuyuni and Anzwani are the worse off in both groups in term of long term accumulation.

Overall, Wasini is better off in the long term and in the short term whilst Anzwani and Kichangani are the worse off. However in two cases the least food secure villages are better off. In the second round of the food coping index and the short term accumulation index, Anzwani's groups become relatively more food secure than similar groups in other villages. This could be explained by a real change between the two rounds of survey or by a bias in the collection of the data. The second difference occurs in Kichangani in terms of long term accumulation where at the village and group level, the scores are in the highest half rather than in the lower half.



The variation of the relative food security in the long term could be explained by the fact that some groups sacrifice the short term security for the long term, thus Kichangani being worse off in terms of short term coping strategies is better off in terms of accumulation. Priorities of groups can vary according to their activities, their assets or according to their locations. The scores vary across and within villages. The aim of the next section is to investigate what could cause such variations.

## **7.3 A SHOTGUN APPROACH**

The variability of the scores could have different causes such as the dominant economic activities of the groups, their demographic characteristics, the practice of subsistence agriculture or the ownership of land. 21 variables were measured for each household. The variables which were thought to have the most likely influence on the scores were tested. A more detailed analysis of some of these parameters is carried out in chapter 8 and 9.

### **7.3.1 Demographic parameters**

The use of demographic parameters (e.g. household size) in detecting vulnerable households has been tested and proved effective (Haddad *et al.*, 1994). The household size, the number of sources of income and the number of dependants per sources of income were believed to have a potential effect on the household food security. In the survey all the informants were asked how many people ate and shared their money in the house (see fig. 6.1) and how many people brought food or money regularly. On the basis of these results the number of dependants was calculated for each household (i.e. household size/number of economically active people).



The average household size, number of sources of income and number of dependants were calculated and averaged for all the groups (quartiles of each village and quartiles calculated for the overall sampled population). Table 7.16 presents the averaged demographic parameters for each village.

**Table 7.16: Demographic parameters averaged at the community level**

Villages	Household size		Sources of Income		Dependants	
	Mean	SD	Mean	SD	Mean	SD
Wasini	6.17	3.37	1.24	0.52	5.26	2.85
Kichangani	6.77	4.08	1.58	0.84	4.56	2.49
Anzwani	6.36	2.76	1.41	0.64	5.08	2.54
Mkwiro	5.3	2.83	1.25	0.45	4.41	2.4
Kibuyuni	6.97	3.30	1.3	0.7	5.6	2.7
All	6.22	3.23	1.3	0.63	4.98	2.6

Using ANOVA it was shown that the average household size, source of income and number of dependants per households did not vary significantly across villages ( $p>0.05$ ). The demographic information was aggregated at the quartile level and it was shown that the household size and the number of dependants did vary significantly ( $p<0.05$ ) between the overall quartiles.

The correlations between the demographic parameters and the household scores was then investigated on the basis of the aggregated data. The significant relations are presented in table 7.17.

**Table 7.17: Influence of the household size and of the number of dependants on the food security scores**

Activities	Household size	Number of dependants
FCSI	-0.407	NS
STAI	-0.699	-0.492

$n=30, r_{critic.}=0.361$  for  $\alpha=0.05$

No significant correlations were found between the scores of the second round and the demographic parameters. Table 7.17 confirms partly the results found by Haddad *et al.* (1994). It shows that a significant negative correlation was identified between the household size and the short term scores. Thus in the short term, the larger the



household, the lower the food coping ability whereas the number of dependants per source of income did not affect the FCSI. The correlation is particularly high (-0.699) with the short term accumulation index. The larger the household the less it can accumulate in the short term (first round).

No significant correlation were detected between the demographic parameters and the long term scores. An explanation for this could be that the household size varies in time. The household is a flexible and adaptable unit, it is not fixed in time as individuals migrate, children are born while others leave (see chapter 4). This means that the strategies used by the households in the last ten years is not closely linked with the size of the household in the present. Thus, the fact that the household size does not have strong effect on the long term indices could be expected.

The number of dependants is significantly negatively correlated only with the short term accumulation index. The STAI represent the strategies used by the households in case of surplus. A high number of dependants does not allow as many opportunities for surplus to occur.

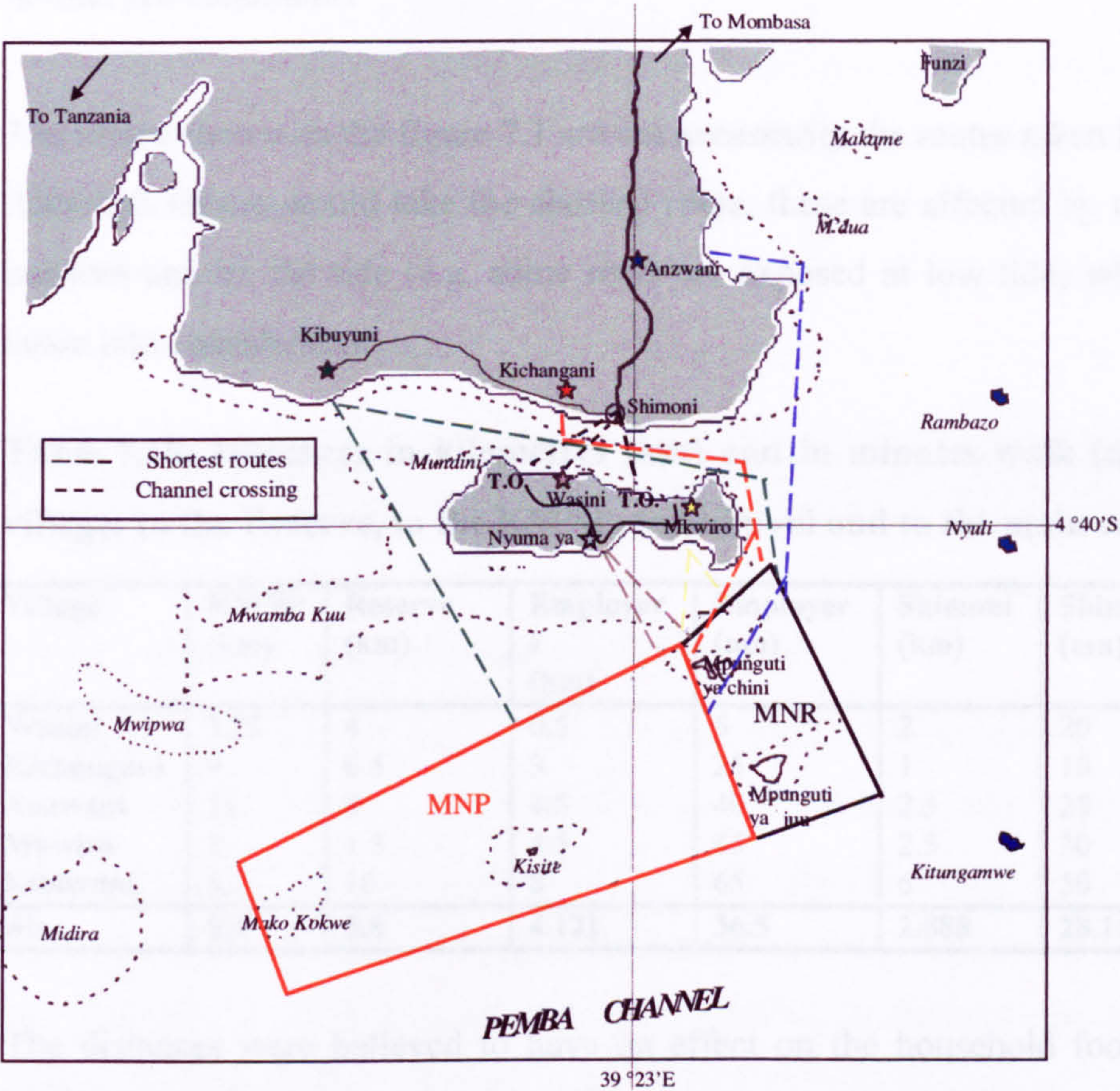
As found by other studies, the household size contributes negatively to the level of short term food security of the households (Haddad *et al.*, 1994).

### **7.3.2 Distances**

Most benefits of MPAs attributed to fish migration are observed at distances less than 1 km of the boundaries (Roberts and Polunin, 1991, DeMartini, 1993, Russ and Alcala, 1996a, 1996b). It was suspected that the socio-economic effects of the KMNP would also be affected by the distance of the communities to the KMNP. Similarly, the distances of the studied communities from the Reserve, where fishers can fish with traditional methods, from the main employers and from the main market centre (i.e. Shimoni) were thought to have potential impacts on the household food security.



The distances from the villages to the KMNP and Reserve were calculated by measuring on an Admiralty chart (Chart n°860) the shortest distances from the villages to the nearest bordering point of the KMNP and Reserve (see fig. 7.1). A similar method was used to estimate the distance in km of each community from the main tour operators.



**Figure 7.1: Estimation of the distance from the KMNP and Reserve to the villages**

Figure 7.1 illustrates the way in which the distances were estimated. Wasini and Mkwiwo had two possible launching locations, the nearest ones to the border of the Reserve and KMNP was used to measure the shortest distances. The distances from the villages to the main employer on the southern side of Wasini island were estimated by measuring the length of the foot paths. The port is located in Shimoni.



The distances from the mainland villages to the employers included the distance from the villages to Shimoni and the length of the channel crossing to the main employers (approximately 2 km). The boat trip from the mainland to go to the main employers on the island was approximately 15 minutes. The channel crossing from Wasini to Shimoni (approximately 20 minutes) and from Mkwirow to Shimoni (approximately 25 minutes) were timed. All of these times were taken in good to normal sea conditions.

The routes shown on the figure 7.1 are not necessarily the routes taken by the fishers. Although fishers would take the shortest route, these are affected by the winds, the currents and by the tide (e.g. some reefs are exposed at low tide) which were not taken into consideration.

**Table 7.18: Distances in kilometres (km) and in minutes walk (mn) from the villages to the Reserve, to the KMNP, to Shimoni and to the main employer**

Village	KMNP (km)	Reserve (km)	Employer s (km)	Employer (mn)	Shimoni (km)	Shimoni (mn)
Wasini	3.25	4	0.5	5	2	20
Kichangani	9	6.5	3	25	1	10
Anzwani	11	8	4.5	40	2.5	25
Mkwiro	2	1.5	4.5	45	2.5	30
Kibuyuni	8.5	10	8	65	6	50
All	6.4	5.8	4.121	36.5	2.888	28.119

The distances were believed to have an effect on the household food security so correlations between the distances and the households’ scores were investigated. However, the distances were measured at the village level which meant that there is no variability of the distances within the villages. Thus the matrix used as a basis for the correlations was composed only of the data aggregated at the village level and at the overall level (5 villages and the overall data).

**Table 7.19 : Correlations between the distances and the food security scores**

Scores	KMNP	Reserve
FCSI	NS	NS
STAI	-0.891	NS
LTDI	NS	NS
LTAI	-0.835	-0.88

*n=6, r<sub>critic.</sub> = 0.79 for α = 0.05*



The results presented in table 7.19 show that the average distances of the households from the employers or from Shimoni do not affect the scores significantly. However, the further away from the KMNP, the less accumulation in the short and long term. Furthermore, the distance from the Reserve has negative significant effects on the long term accumulation capacities.

According to the analysis, the distances, measured as described do not have a strong impact on the scores except on the short and long term accumulation capacities for the distances from the Reserve and the KMNP. Other factors might have more impact on the scores.

### **7.3.3 Economic activities**

#### **7.3.3.1 The economic activities and the location**

Economic activities are part of the household's livelihood system as defined by Davies (1993). They are believed to have an important role in determining the households' level of food security. In the study sites, five main economic activities were identified and were "fishing", employment in tourism related to the presence of the KMNP ("T.MNP"), employment in tourism operations not related to the presence of the KMNP such as sports fishing ("T.Oth."), "labour" (mainly casual workers), "qualified" employment (including religious and non-religious teachers, civil servants) and "other" which includes mainly self employed (e.g. traders, shop owners, shop keepers). When referring to the categories of activities, inverted commas will be used. For the purpose of this research, economic activities were defined as activities which bring a monetary income, at least partly. They are opposed to subsistence activities.

For each group (i.e. quartiles, villages), a percentage of households depending at least partly on each activity was calculated (i.e.  $\{(\text{mean fisher per household}/\text{mean economically active people per household})\} * 100$ ). Fishing is the dominant activity

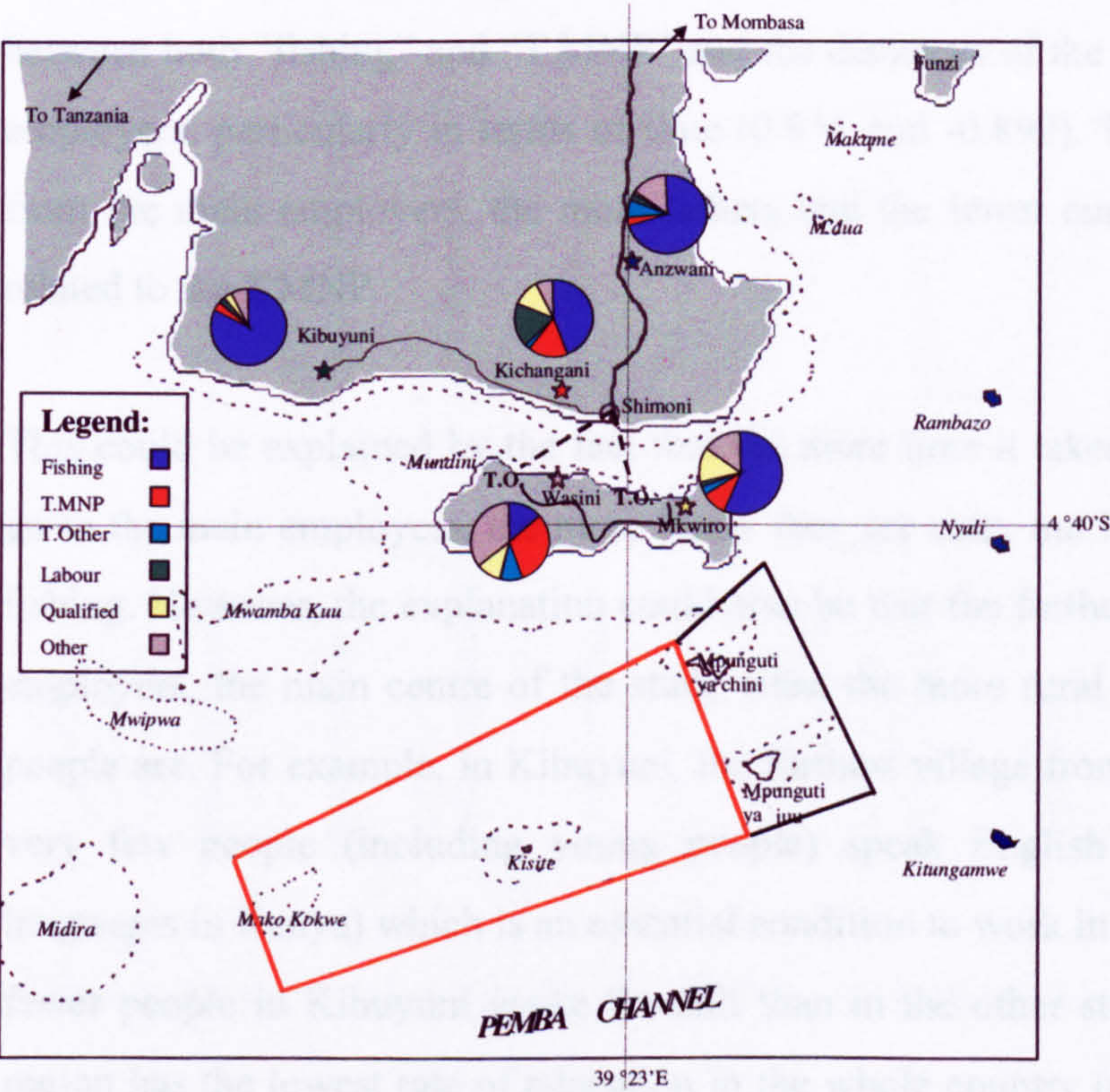


in the area with as much as 54% of the surveyed households depending at least partly on fishing.

**Table 7.20 : Percentage of households depending at least partly on each economic activity in the study sites**

Activities	Wasini	Kichangani	Anzwani	Mkwiro	Kibuyuni	All
Fishing	14	43.9	69.9	56	82.2	54
T.MNP	30.7	15.8	3	9.6	3.7	12.1
Tourism	8.8	2.4	7.5	3.2	0	4.6
Labour	0	18.3	3	2.4	2.8	4.5
Qualified	10.5	12.2	1.5	13.6	3.7	8
Other	35.9	7.3	15	15.2	7.5	16.8

As shown in the table 7.20 the economic structure varied across the villages, Wasini having less households depending on fishing than the other villages and more households depending on employment in tourism related to the presence of the KMNP (“T.MNP”).



**Figure 7.2: Map of the proportion of economic activities on which households depend in the studied villages**



Figure 7.2 suggests that the differences of the economic structure across villages could be linked to the distances of the study sites from the KMNP or the main employers (based on the Wasini Island). The correlations between the percentage of households depending on each activity and the distances were investigated. As it was explained in the section 7.3.2, the basic matrix for these calculations was composed of 6 cases (distances measured at the village level and at the overall level).

**Table 7.21 : Correlation between the distances (in km and in minutes) and the economic activities**

Activities	Employer (km)	Employer (mn)
Fishing	0.953	0.955
T.MNP	-0.873	-0.899

*n=6, r<sub>critic</sub>=0.79 for α=0.05*

Table 7.21 only presents the significant correlations ( $r>0.79$ ). The distances have an impact on a minority of economic activities. However, there are strong correlations between both “fishing” and “T.MNP” and the distances of the communities from the employers, particularly in terms of time (0.955 and -0.899). Thus, the further away from the main employers, the more fishers and the fewer employed in the tourism related to the KMNP.

This could be explained by the fact that the more time it takes for the employees to go to the main employers, the more likely they are carry out local activities, mainly fishing. However, the explanation could also be that the further away from the main employers, the main centre of the study sites, the more rural and the less educated people are. For example, in Kibuyuni, the furthest village from the main employers, very few people (including young people) speak English (one of the official languages in Kenya) which is an essential condition to work in tourism. Furthermore, fewer people in Kibuyuni spoke Swahili than in the other study sites. The coastal region has the lowest rate of education in the whole country (GK, 1995) and fishers are often the least educated (Malleret-King, 1996). In Kibuyuni, more than 80% of the households depend at least partly on fishing.



The analysis of the economic structure in relation to the distances of the villages shows that it would be possible to say which type of activities (“fishing” or “T.MNP”) is likely to be carried out by the households depending on how far away they are located from the employers.

1.1.1.1 Economic activities and food security

The economic structure varied across the villages but also within the villages, at the quartile level, as the figure 7.3 illustrates.

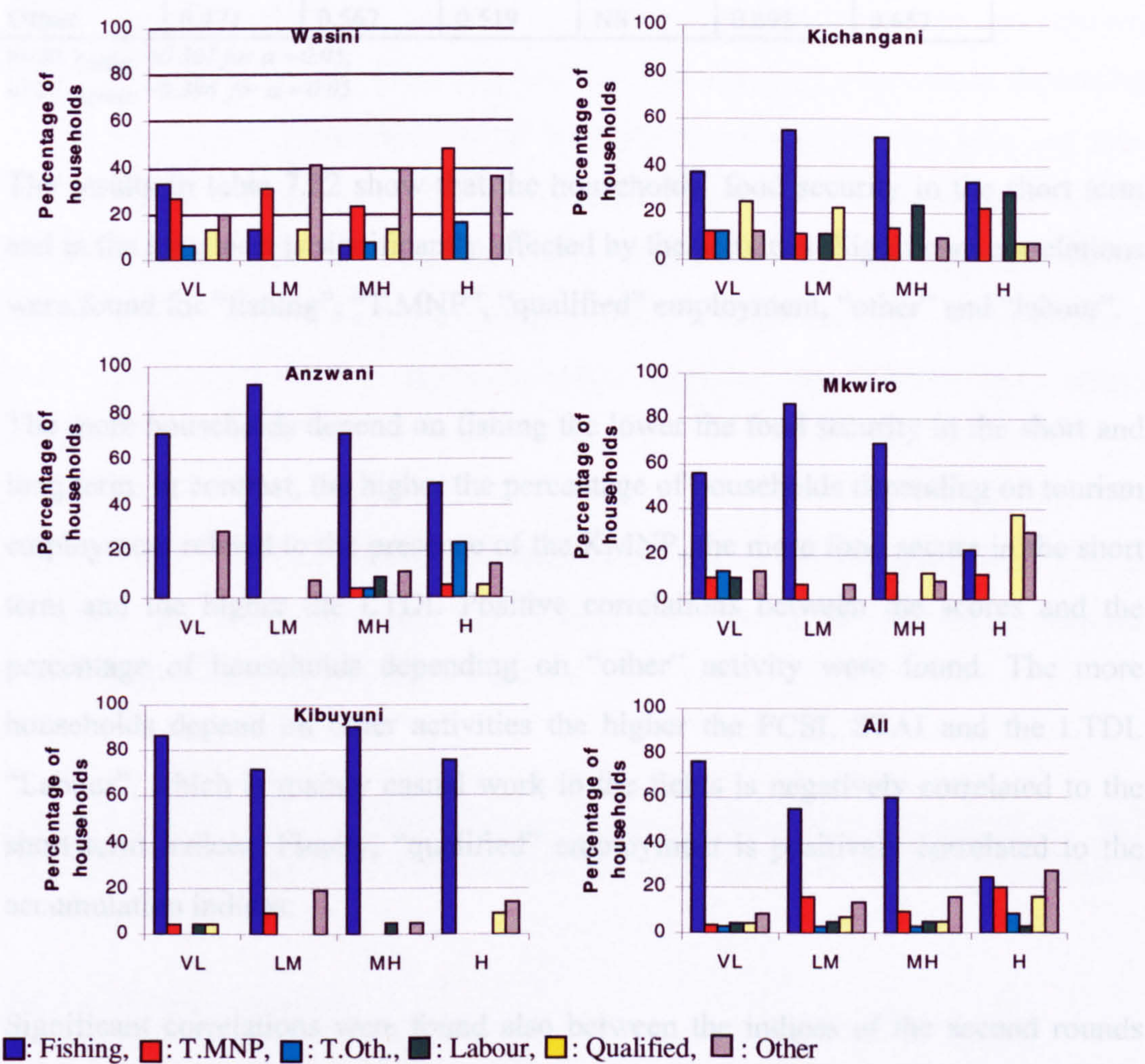


Figure 7.3: Main economic activities across the short term food security groups in each village and in the overall population



The percentage of the households depending at least partly on fishing appears to decrease in the higher food security groups except in Kibuyuni. In view of the potential influence of the activities on the household scores, the correlation between the main types of activities and the scores was examined (table 7.22).

**Table 7.22: Correlations between economic activities and food security scores aggregated at the short term food security group level**

Activities	FCSI	STAI	LTDI	LTAI	FCSI2	STAI2
Fishing	-0.469	-0.519	-0.478	-0.429	NS	-0.464
T.MNP	0.413	0.439	0.529	NS	NS	NS
T.Oth.	NS	NS	NS	NS	NS	NS
Labour	NS	-0.429	NS	NS	-0.468	-0.474
Qualified	NS	0.423	NS	0.446	NS	NS
Other	0.471	0.567	0.519	NS	0.495	0.657

*n=30, r<sub>critic.</sub>=0.361 for α = 0.05;*  
*n=25, r<sub>critic.</sub>=0.396 for α = 0.05*

The results in table 7.22 show that the households’ food security in the short term and in the long term is significantly affected by the activities. Significant correlations were found for “fishing”, “T.MNP”, “qualified” employment, “other” and “labour”.

The more households depend on fishing the lower the food security in the short and long term. In contrast, the higher the percentage of households depending on tourism employment related to the presence of the KMNP, the more food secure in the short term and the higher the LTDI. Positive correlations between the scores and the percentage of households depending on “other” activity were found. The more households depend on other activities the higher the FCSI, STAI and the LTDI. “Labour”, which is mainly casual work in the fields is negatively correlated to the short term indices. Finally, “qualified” employment is positively correlated to the accumulation indices.

Significant correlations were found also between the indices of the second rounds particularly negative correlations between “Labour” and both indices. The more fishers the less accumulation in the second round. Finally the “other” economic activities are relatively strongly correlated to the STAI2 and to the FCSI2. The more households depending on other activities, the higher the scores in the second round.



The analysis of the data with a simple correlation shows that the more fishers the less food secure and the more employment in “T.MNP”, the more food secure. These two activities are the activities most dependent on the KMNP or constrained by the presence of the KMNP.

When looking at figure 7.3, it is possible to notice that in the very low short term food security groups (VL) there are fewer fishers and a higher or similar percentage of households depending on “T.MNP” than in the (medium low) groups in Wasini, Kichangani and Mkwiro. This irregularity affects the strength of the correlation coefficients. This might be explained by the fact that there are differences between the types of work in each category identified. For example, a household depending on tourism related to the presence of the KMNP can have its own boat and take tourists out. It can also have one of its member employed as a waiter or a cook or even as a night guard (it is the case in Kichangani where a large proportion of the people employed in “T.MNP” are night guards). A night guard is less paid than a cook, this might introduce distortions when analysing the “T.MNP” as a whole category.

“T.Oth.” and “labour” are not significantly correlated to most of the scores. This is probably due to the low percentage of these activities in the sampled households (overall respectively: 4.6%, 4.5% and 8%).

### **7.3.4 Land**

#### **7.3.4.1 Land ownership**

Land is an asset which can have an important role in the strategies developed by households to maintain their livelihood systems (as defined by Davies, 1993). One of the last and most desperate measures when households have failed to cope with a crisis is to sell their land and migrate (Watts, 1983, 1988, Maxwell and Frankenberger, 1992). In Kwale District in 1990, 22.5% of the households were



landless (Ministry of Planning and National Development and UNICEF, 1990 cited in Ng’weno, 1995).

In the study sites only 24.3% of the surveyed households had land (individual or family owned). As in other parts of the coast, the land adjudication is not yet finished (see Malleret-King, 1996). Even though tourism has not yet been developed as much as in other parts of the coast, the land market is influenced by the coastal trends and land is too expensive for the local population to buy it. Inheritance is the main path to access land. Thus, most of the households did not own the land on which they lived. This situation can entail instability for them (Ng’weno, 1995). For example, on the Wasini Island a person claimed owning half of the Island and wanted the inhabitants to move even though some people had title deeds. The inhabitants protested and the matter went to court, the man won and the case went to appeal. The case is not settled yet but shows how precarious the households’ situation can be.

Because of the importance of the land issue and the stability that freehold and secure land tenure can bring to households, it was thought that land ownership could be an indicator of higher food security in the short and long term. Thus, informants were asked whether someone in the households owned land, and if so, the size of the plots and whether it was owned individually or not (family plot). Figure 7.4 shows the results derived from the household survey at the village level.

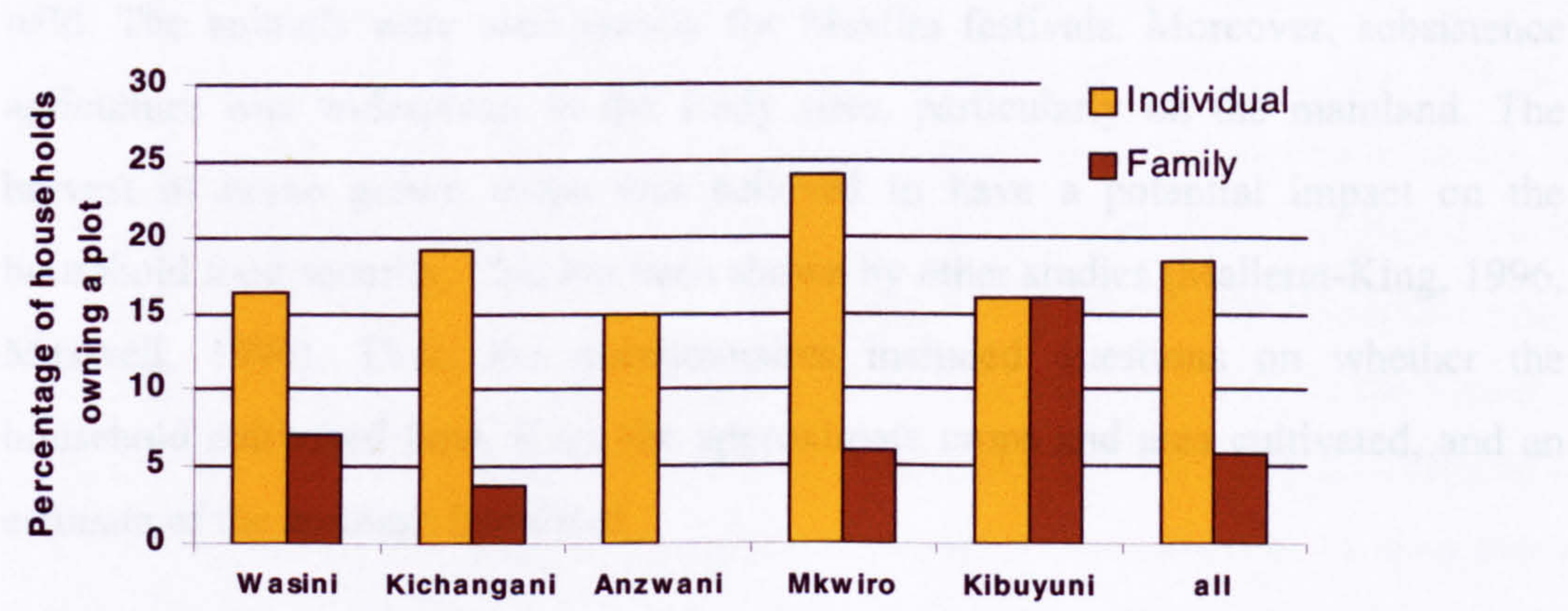


Figure 7.4: Percentage of households owning individual and family plots



The plots were only accounted for if they had been measured and title deeds had been delivered. Overall, 24.3% of the surveyed households had a member owning a plot of some sort. 5.8% of the households had a family plot thus, only 18.3% of the household surveyed had a member owning an individual plot. Usually individual plots were less than 5 acres (2 hectares). Non-divided family plots could be up to 40 acres.

In order to investigate if land ownership could be an indication of household food security, the correlations between the percentage of households owning individual plots and family plots and the scores was tested (at the quartile level). No significant correlations were found. The lack of correlation could be partly due to the relatively low number of households with land. Other explanations for this lack of correlation however could be that, on the one hand, the long term indices do not take account of land ownership; land selling or buying did not emerge as strategies used by the households when the long term strategies were discussed with the informants (see chapter 6). Furthermore, the short term food security might not be affected as much by the land ownership than by the land use.

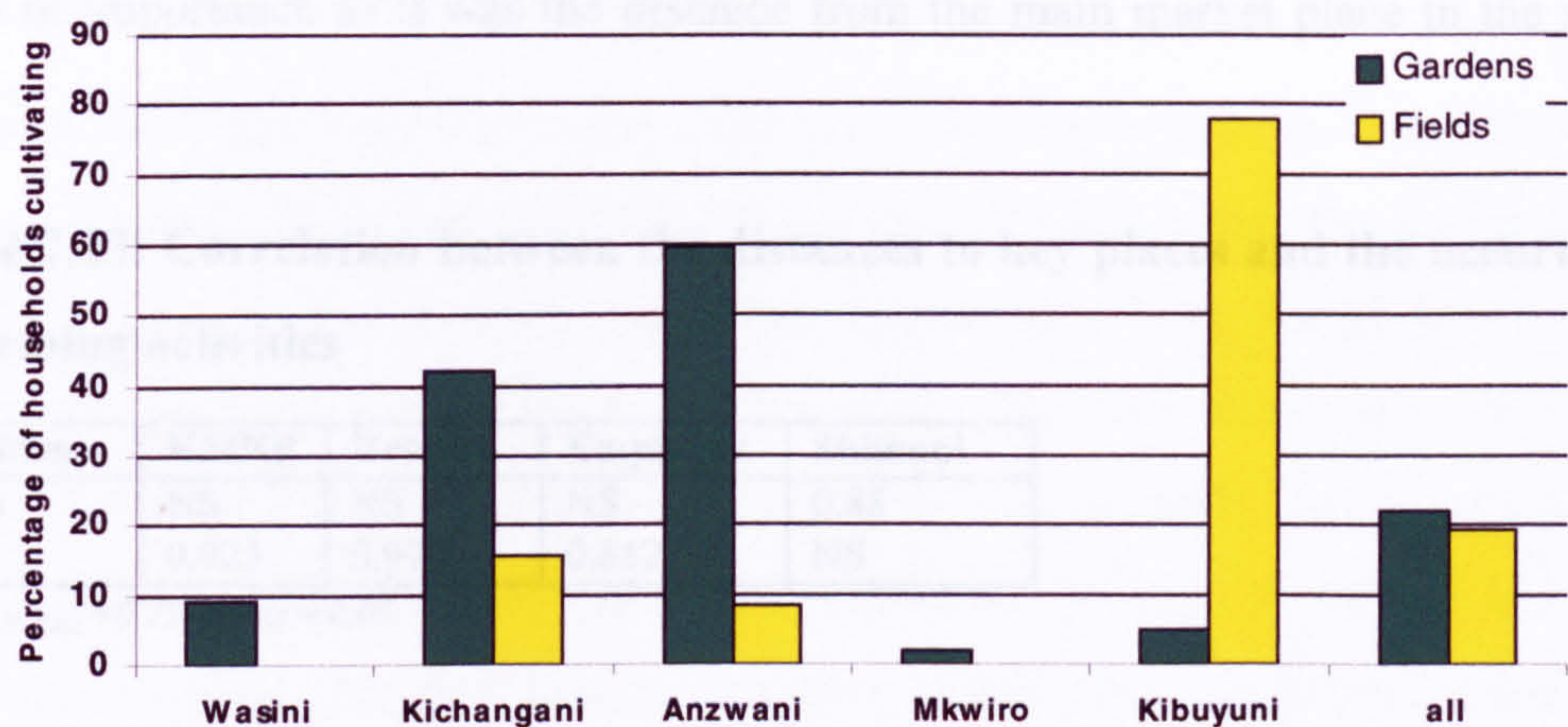
#### **7.3.4.2 Land use**

Most households on the mainland had chickens and very few had goats. On the island, goats ran freely and a few cows belonging to the villages were considered as wild. The animals were used mainly for Muslim festivals. Moreover, subsistence agriculture was widespread in the study sites, particularly on the mainland. The harvest of home grown crops was believed to have a potential impact on the household food security. This has been shown by other studies (Malleret-King, 1996, Maxwell, 1996). Thus, the questionnaires included questions on whether the household cultivated land, if so, the approximate crops and area cultivated, and an estimate of the amounts harvested.

The results of the survey showed that households cultivated “gardens” or “fields”. The distinction was made on the basis of the area and types of products cultivated.



Gardens are less than 0.5 acre (0.2 hectares) in size on which the households grew very small amounts of maize or millet or cassava and pulses (i.e. a large vegetable garden). Mango trees, orange or cashew nuts were often planted. The harvest would be small and would only supplement meals in the harvesting season. In contrast, fields are more than 0.5 acre and often more than one acre. The main crops in the study sites are maize and rice. The maize would be inter-planted with pulses. The harvest from fields could last up to five months using it irregularly, as explained in chapter 6.



**Figure 7.5: Percentage of households farming fields or gardens for subsistence in each village**

Figure 7.5 shows that 41.5% of the households carried out subsistence agriculture approximately equally spread between gardens (22.2%) and fields (19.3%). 27% of the households cultivating owned an individual plot and 7% partly owned a family plot. Moreover, very few households lived on plots that they owned, or cultivated on land they owned. For example, in Kibuyuni, the village where subsistence agriculture was the most widespread (78% of the households cultivated fields), only 16% of the households had individual plots. Traditional slash and burn agriculture is still used. The cleared area is divided between the villagers regardless of whom it belongs so as to have grouped fields. Grouping the fields ensures better defences against wildlife, particularly baboons. The fields are constantly guarded, mainly by women. When a troop of baboon threatens to raid the crop, the women re-group



shout and throw stones at them. By being in a group they have more chance of frightening the baboons away than if isolated.

It was thought that the practice of subsistence agriculture could vary with the location of the villages. As mentioned in the other sections, because the distances were measured at the village level, the correlations between the location and the percentage of gardens, fields and total cultivated was based on the villages and overall averages. The distance from the employer in minutes was not thought to be important in cultivation, however the distance in minutes from Shimoni was thought to be of importance as it was the distance from the main market place in the study site.

**Table 7.23: Correlation between the distances to key places and the occurrence of farming activities**

Activities	KMNP	Reserve	Employer	Shimoni
Fields	NS	NS	NS	0.88
Total	0.923	0.970	0.812	NS

*n=6,  $r_{critic.}=0.79$  for  $\alpha=0.05$*

There are very strong links between the distance of the villages from the KMNP and the Reserve and the percentage of households carrying out subsistence agriculture overall (0.923, and 0.970). The further away from the KMNP and Reserve the more households cultivate gardens or fields. This is logical as being the further away from the KMNP and Reserve is also being the further away from the island, where there is no land to cultivate and where very few households even have gardens.

The results (table 7.23) also show that the further away from Shimoni a village is, the more fields are cultivated. This can be explained by the fact that the further away from the main market place and urban centre the more space for fields. This is the case for Kibuyuni. The cultivation of fields is also positively correlated with the distance from the main employer (0.812). Again, the reason for this could be that the further away from the main employer, the further away from the island where there is no land to cultivate.



It was thought that the practice of subsistence agriculture could have an impact on the households' scores. The correlations between the percentage of households in each quartile cultivating gardens or fields and the households' scores were investigated.

**Table 7.24 : Correlations between the percentage of the households cultivating and the food security scores**

Scores	STAI	LTDI	LTAI
Gardens	-0.472	-0.442	NS
Total	-0.464	NS	-0.469

*n=30,  $r_{critic.}=0.361$  for  $\alpha=0.05$*

There are no significant correlations between subsistence agriculture and the Food Coping Strategy Index nor between subsistence agriculture and the scores of the second round. In addition, no significant correlations were found between the cultivation of fields and any of the scores either. The only scores affected by the overall cultivation are the short and long term accumulation indices (STAI and LTAI) which are moderately negatively affected (-0.464, -0.469). The more household cultivate the less they accumulate. Finally, the households' short term accumulation (STAI) and long term divestment scores (LTDI) are negatively affected by garden cultivation (-0.472 and -0.442).

Positive correlations between subsistence agriculture and the scores were expected. There could be two explanation for these surprising results. The first one is that the fact that households have access to home grown products means they do not need to buy so much at the shops, thus the accumulation index might be reduced (e.g. they do not need to buy maize so often). However, this does not explain the negative correlation between the LTDI and garden agriculture. Moreover, the first round of survey was carried out prior to the maize harvest. The crop was not yet ready, thus in the short term it would not have affected significantly the accumulation index of the households. Furthermore, the households tend to use their production only when necessary, thus if there was a surplus of money they would buy food stocks.



The second and more plausible explanation is that the households which cultivate represent a type of production system. Economic activities and the practice of subsistence agriculture could be linked. The negative correlations found between subsistence agriculture and the scores could be a reflection of the impact of the economic activities on the scores.

Thus, the households cultivating could correspond to a category of households which have activities entailing lower food security. For example, its was found that 70% of the households cultivating gardens or fields were households depending mainly on fishing, which are less food secure in short term. Moreover, the correlations between subsistence agriculture and percentage of households depending on each type of economic activities were tested (table 7.25).

**Table 7.25: Correlations between the economic activities and the occurrence of subsistence farming**

Activities	Garden	Fields	All
Fishing	NS	0.544	0.591
T.MNP	NS	-0.438	-0.555
Labour	0.484	NS	NS
Qualified	NS	NS	-0.417
Other	NS	-0.447	-0.559

*n=30, r<sub>critic.</sub>=0.361 for  $\alpha = 0.05$*

Table 7.25 shows that significant correlations were found between some of the activities and the practice of subsistence agriculture. Particularly “fishing”, “T.MNP” and “Other” are correlated to the cultivation of fields and both cultivation confounded. The more fishers the more households cultivate fields and the more cultivate overall. In contrast, the more households depend on tourism related to the presence of the KMNP and the more depend on “other” activities, the less cultivate.

These results could confirm the second explanation by which subsistence agriculture reflects economic activities and the impact of the economic activities on the scores. The more cultivation, the more likely the household is to be fishing dependent, the more fishers the less food secure (tables 8.23 and 7.25). The less cultivation the more “T.MNP”, the more “T.MNP” the more food secure (tables 7.22 and 7.25).



The analysis of the connections between the distances and the percentage of households cultivating gardens or fields might indicate a similar idea that it might be the overall production systems with the dominating activities which most influence the scores and are influenced by the distances.

## **7.4 CONCLUSION**

On the basis of the household survey, six food security scores were calculated for the surveyed households. The short term food coping index and the short term accumulation index were measured during the rainy season (South East monsoon) and during the dry season (North East monsoon). The results were analysed with the aims of comparing the socio-economic situation of the five studied communities and of investigating the causes for the differences between these communities if any.

### **7.4.1 On the analysis of the scores**

The differences in the scores across the villages were investigated in order to be able to compare the communities' socio-economic situations. The results showed that the short term indices for both round of surveys (FCSI, FCSI2, STAI, STAI2) and the long term indices (LTDI, LTAI) varied significantly across the villages.

Moreover, the communities were divided into groups (quartiles) on the basis of the households' short term food security (average of STAI and FCSI, first round). The analysis of the variability of the scores of the groups across villages showed that except for the accumulation indices, the average scores of the identified groups varied significantly across the villages.



Having established that the scores varied according to the villages and groups, it was possible to compare the communities' results. When considering the first round only Wasini and Mkwiro emerged as the most food secure overall, followed by Kibuyuni. Anzwani and Kichangani appeared the least food secure (table 7.4). A similar pattern was found for the short term food security groups (see tables 7.9, 7.11 and 7.15).

#### **7.4.2 On the causes of variability of the scores**

On the basis of the first analysis, the reason for the variability in the scores was investigated by using Pearson's correlation coefficients. The household size, the number of dependants per source of income (Haddad *et al.*, 1994), the location of the villages (distance from the KMNP and Reserve, the main employment and market centre), the economic activities of the households, land ownership and land use, are all parameters which were thought to influence the scores. A shotgun approach (Bernard, 1995) was used in order to examine the way they were correlated with each other and how they affected the scores.

As expected (see Haddad *et al.*, 1994), household size and the number of dependants were found to affect negatively household food security (the short term scores of the first round). Surprisingly, the analysis showed that the more households cultivated "gardens" or "fields", the less food secure the community was in the short and long term. The explanation for these surprising results might be that subsistence agriculture is part of a specific production system and associated with certain types of economic activities. For example, 70% of the households cultivating were also at least partly dependent on "fishing". This idea was confirmed by the existence of a positive correlation between "fishing" and "cultivating", and a negative correlation between the percentage of households depending T.MNP and "cultivating". Thus more subsistence agriculture, the less tourism related to the KMNP and the more fishers.



Finally, it was shown that the economic activity on which the households depend could give an indication on the level of food security. This is particularly true for fishing, T.MNP and “other” activities. The more households depend on fishing the less food secure they are, the more households depend on “other” and on T.MNP the more food secure they are.

It was found that the distance of the villages from the KMNP and from the Reserve had significant negative effects on the accumulation indices but that the location of the villages did not have as much direct influence on the scores as was first suspected. However, the percentage of households depending on fishing and on T.MNP was highly dependent on the distance of the villages to the main employers. In the same way, subsistence agriculture depended on the location of the village. The further away the village is from the employer, the more fishers ( $r > 0.9$ ) and the more cultivation. The further away from the employer, the less households depended on “other” activities and on tourism related to the KMNP ( $|r| > 0.87$ ). It was suspected that an indirect relationship existed between the scores and the distances (i.e. the scores are affected by the economic activities which are themselves influenced by the distance to the main employers). Significant relationships found are summarised in table 7.26.



**Table 7.26: Signs of the significant correlations between identified variables and the food security scores, and indication of indices' strength**

Variables	FCSI	STAI	LTDI	LTAI	FCSI2	STAI2
<b>Demographic:</b>						
Household size	-	--	o	o	o	o
Dependants	o	-	o	o	o	o
<b>Distances:</b>						
KMNP	o	-	o	-	o	o
Reserve	o	o	o	-	o	o
<b>Economic activities:</b>						
Fishing	-	-	-	-	o	-
T.MNP	+	+	+	+	o	o
Labour	o	-	o	o	-	o
Qualified	o	+	o	+	o	o
Other	+	+	+		+	++
<b>Land:</b>						
Gardens	o	-	-	o	o	o
Total agriculture	o	-	o	-	o	o
<b>Indicators' strength score*</b>	<b>2</b>	<b>5.5</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>1.5</b>

*o: none, -: negative, --: high negative correlation, +: positive, ++: high positive<sup>17</sup>*  
*\* o: scores 0, - or +: score 0.5, -- or ++: score 1. The strength score was calculated by adding the values associated to each significant correlation.*

One of the most important indirect variables to affect the scores was thought to be the location of the villages. The following table summarises the significant correlations between the distances and the other parameters.

**Table 7.27: Sign of the significant correlations between the location of the villages and other parameters**

Parameters	KMNP (km)	Reserve (km)	Employer (km)	Employer (mn)	Shimoni (km)
<b>Economic activities:</b>					
Fishing	o	o	--	--	o
T.MNP	o	o	+	++	o
<b>Agriculture:</b>					
Fields	o	o	o	o	+
Total	++	++	++	o	o

*o: none, -: negative, --: high negative correlation, +: positive, ++: high positive*

From the analysis of the surveys summarised above, it was possible to establish that the situation of the communities surrounding the KMNP varied. These variations



could be partly explained by the demography and the practice of agriculture but also by the dominant economic activities, particularly “fishing” and T.MNP. The importance of these activities was itself influenced by the distance of the communities from the main employer.

Finally, the comparison of the strength scores presented in table 7.26 shows that the STAI and the LTAI are the strongest indices. This means that they give more information about the households' attributes than any of the other indices as they are correlated with more of the identified parameters. The short term indices calculated in the second round of survey (FCSI2 and STAI2) are the least useful. This should be expected as the second round was incomplete and unreliable (see section 6.2.4.3).

### **7.4.3 On the effects of the KMNP**

The ultimate aim of the PhD is to determine, from a socio-economic point of view, whether the KMNP benefits the surrounding communities. The fact that the scores vary in correlation with the percentage of households depending on tourism activities related to the presence of the KMNP and on fishing, that the distance of the villages from the KMNP affects some of the scores, and that the economic structure of the communities is affected by the distance from the main tourist operation (related to the presence of the KMNP) support the idea of the KMNP having a socio-economic effect on the surrounding communities.

However, the identification of general links between the KMNP and the socio-economic situation of the surrounding communities is not enough to explain the differences within the villages (e.g. more tourism activities and fewer fishers in the more food secure groups than in the medium low secure groups). Moreover, one of the fundamental aims of this research was to detect the effects of the KMNP in terms of the fishery from a socio-economic point of view. Having established that the more fishers there are, the less food secure the groups, gives an information of the likely

<sup>17</sup> A correlation might be considered highly positive or negative if:  $|r_s| \geq r_{critic} + 0.5(1 - r_{critic})$ .



status of the fishers' households in the study sites but does not give any indication on the link between the fishing and the KMNP.

The general investigation done in this chapter was essential in giving a picture of the interactions between the different factors and their contribution to the overall household food security. However, more details are needed in order to know in which way the KMNP affects the fishing households and whether it affects the surrounding fishery. More details are also needed to understand the conditions in which the KMNP has positive effects through tourism. Thus, a detailed analysis of the influences of the KMNP on the communities through fishing is carried out in the chapter 8.



## **8 The Kisite Marine National Park and the fishery**

The analysis of the data carried out in chapter 7 showed that the presence of the KMNP might affect the socio-economic situation of the surrounding fishing communities. This, particularly through the activities of fishing and tourism related to the presence of the KMNP. The aim of this chapter is to investigate further the ways in which the KMNP affects the fishery.

### **8.1 METHODS**

In order to determine whether the KMNP has had specific influences on the surrounding fishery, the variability of the food security of the households depending mainly on fishing was investigated. Parameters likely to impact on the fishers' households' scores were identified and their influence tested. For this, parametric and non-parametric tests were used.

#### **8.1.1 Parameters**

The objective of this chapter is to detect the impacts of the KMNP on the surrounding fishery from a socio-economic angle. However, variables not directly linked to the KMNP may also influence the scores (see chapter 7). The potential impact of demographic parameters, subsistence agriculture and of the type fishing systems (gear, vessel, see section 8.3.2) were investigated as well as the distance of the KMNP, suspected to have a direct influence.

Demographic parameters already discussed in chapter 7 include household size and the number of dependants (see definition in section 7.3.1). The question was whether



demographic parameters influenced the fishers' households' scores. Similarly, subsistence agriculture was found to have an impact on the scores when the whole surveyed population was taken into consideration (see chapter 7). However, the negative impact was believed to be caused indirectly by the strong influence of one production system (i.e. a production system based at least partly on fishing).

No correlations were found between land ownership and the scores averaged at the short term food security groups level. None of the households had bought land and if the household members owned land it was inherited. It was believed that land ownership would be unlikely to have an influence on the food security scores even though it could be part of the indicators of higher food security. Thus, it was not considered as a parameter causing variability amongst the fishing households scores.

Parameters characterising the households' fishing system described in chapter 5 were suspected to influence the short and long term situation of the households. Thus, links between scores and variables such as the use of boats, the participation in shifts (i.e. shifts organised by the cooperative in charge of the boats given by KWS) and the ownership of a boat were investigated.

Finally, as mentioned previously (chapter 2 and chapter 7), one of the main ways in which an MPA can influence the surrounding fishery is through fish migration. Moreover, most of the benefits of MPAs in terms of fish migration are observed at less than 1km from the MPAs' boundaries (see 7.3.2, chapter 2). Thus, it was thought that the distance from the KMNP could be an essential parameter in the analysis of the effects of the Kisite Marine National Park. The relationship between the distance of the villages from the KMNP and Reserve and the scores were therefore investigated.

However, it was suspected that the distance of the fishing zones from the KMNP could be a better indicator of the influence of the KMNP. Thus, the villages were ranked according to the location of their main fishing zones in relation to the KMNP boundaries and to coral reefs (see fig. 8.4 and section 8.3.3.2).



## **8.1.2 Analytical tools**

To study the variability of the fishing households' food security, and the causes of this variability, analyses of variance, t-tests, and correlations were used.

### **8.1.2.1 Variability and division in groups**

In order to study the variability of the scores across the economic activities, the villages and groups, the main parametric tests carried out were ANOVAs. Kruskal-Wallis one way analysis of variance was also used in order to confirm whether the use of the parametric test was justified (see section 7.1.1.2).

To analyse the situation of the fishing dependent households in relation to other groups of economic activities, the 210 households surveyed were divided into seven categories of activities. These were the six categories already described in section 7.3.3 (i.e. "fishing", "T.MNP", "T.Oth.", "labour", "qualified", "other") and a seventh category "mixed" corresponding to the cases when households depended as much on one activity than on another one (in relation to the total number of household members carrying out each activity).

Moreover, to study the variability across the "fishing" households, these were divided into quantitative short term food security groups (quartiles) similarly to the way in which the whole population was divided (see section 7.1.2.2). The groups correspond to very low (VL), medium low (ML), medium high (MH) and high (H) short term security. This division into groups enables me to analyse further the variability and causes for the variability within the fishers groups.



### 8.1.2.2 Investigation of the causes for variability

Three main analytical tools were used to investigate the influences of parameters on the fishers' households' scores. Pearson' correlation coefficient was used when the variables were measures at an interval/ratio level, particularly when investigating the influence of demographic parameters and of the distances from the KMNP or Reserve on fishing households' scores. To identify the significant correlations, critical correlation coefficients were calculated (see equation (1), section 7.1.1.1). In addition, significant correlations were divided into two groups denoted as 'strong' and 'weak' in relation to a mid-strength coefficient ( $r_m$ ). The  $r_m$  was calculated as the mid point between the critical coefficient and 1 (see section 7.4.2, table 7.26).

In cases where at least one of the variables was measured at the ordinal level (e.g. the fishing zones), Spearman's rank order correlation coefficients were used. The Spearman's rank order correlation coefficient is a measure of association between ordinal variables particularly adapted to the case where the data take many values and cannot be presented into a two by two table (Argyrous, 1997). It was thus thought to be the most appropriate measure to study the link between the rank of the fishing zones and the scores.

Finally, some variables were measured at the nominal level (0: no and 1: yes) which included the cultivation of gardens, of fields, the ownership of boats, the use of boats and participation in the shifts. The aim was to investigate whether, at an individual level, households scoring a 1 (e.g. owning at least one boat) would be better off than households scoring a 0 (e.g. not owning a boat). In order to do this, a two sample t-test was used (Argyrous, 1997).

To give more information about the causes for variability in the scores, Pearson's correlation coefficients were also calculated on the basis of the data averaged at the group level (i.e. quartiles). The matrix for the investigation of the link between the averaged scores and these variables was composed of the percentage of occurrence of each variable (percentage of yes answers) at the group level.



Significant results of t-tests do not give any information concerning causality between variables (Argyrous, 1997). This implies, as already mentioned in chapter 7 (Bernard, 1995), that cautious interpretation is warranted.

The strength of the indices in relation to the fishing households is measured in the concluding section as it was done in chapter 7 (tables 8.22 and 8.23).

## **8.2 THE STATUS OF FISHERS' HOUSEHOLDS**

It was previously suggested that economic activities could affect household food security (section 7.3.3.2). For example, it was found that the more fishers there were in a group, the less food secure it was. The variability of the scores across economic activities was investigated further in order to compare the situations of fishing households and of other households.

### **8.2.1 Variability across economic activities**

In order to investigate further the potential role of the economic activity undertaken in indicating the level of food security, households were divided into groups of dominant activities. The main difference from the categories defined in chapter 7 is that when two activities are carried out at the same level in a household, the household is classified as “mixed”. This stringent classification is aimed at ensuring as much as possible that, when investigating the status of the fishers' households, no other economic activity could influence the scores as much as fishing. Thus, for example, if two sources of income in a household are fishers and one is a working for a tour operator, the household is considered as “fishing”. If two active household members are involved full time in different activities, the household would then be considered as “mixed”.



The average scores for each activity were calculated (table 8.1), an ANOVA and a Kruskal-Wallis one way analysis of variance were carried out to determine whether the scores varied significantly according to the activity.

**Table 8.1: Food security scores averaged for each activity**

Activities	FCSI	STAI	FCSI2	STAI2	LTDI	LTAI
Fishing	142	11.7	161.4	12.6	116.3	57.3
T.MNP	163.7	14.1	161	14.6	123.2	56.5
Tourism	155.9	14	162.6	14	113.8	63.3
Labour	149.8	11	157.5	12.5	120.6	58.8
Qualified	155	15.3	163.3	15.2	118.5	64.8
Other	156.3	14.6	164.9	13.5	122.6	63.7
Mixed	145.4	13.4	164	14	115.8	66.8

**Table 8.2: Variability of the food security scores according to the main activities**

Scores	ANOVA		Kruskal-Wallis	
	F	p	K-W	p
<b>FCSI</b> <small>N=209</small>	4.394	p<0.01	28.063	p<0.01
<b>FSCI2</b> <small>N=146</small>	0.170	NS	3.549	NS
<b>STAI</b> <small>N=210</small>	5.398	p<0.01	32.043	p<0.01
<b>STAI2</b> <small>N=146</small>	1.943	NS	9.969	NS
<b>LTDI</b> <small>N=203</small>	0.743	NS	8.398	NS
<b>LTAI</b> <small>N=203</small>	1.705	NS	7.78	NS

The results of the analysis presented in table 8.2, show that the parametric and the non-parametric tests have similar results. The short term scores of the first round (FCSI and STAI) vary significantly according to the economic activity. Table 8.3 presents the activities ranked according to their short term scores in the first round.

**Table 8.3: Averaged food security scores and ranks for each activity**

Activities	FCSI	STAI	Median
Fishing	7	6	6.5
T.MNP	1	3	2
Tourism	3	4	3.5
Labour	5	7	6
Qualified	4	1	2.5
Other	2	2	2
Mixed	6	5	5.5

The table above shows that both in terms of short term coping and accumulation capacities (FCSI, STAI), fishing households are worse off than households



depending on other activities. Fishing households are followed by the households predominantly dependent on “labour” and “mixed”. In contrast, households depending on tourism related to the KMNP (“T.MNP”) and on “other” activities are significantly better off in the short term.

The pattern found at the overall level was also detected at the village level. ANOVAs and Kruskal-Wallis tests were carried out on the scores at the village level to see whether in each village the scores varied according to economic activities. Table 8.4 presents the average scores which were found to vary significantly according to the activities ( $p<0.05$ ) and the ranks of the activities according to their average scores. Activities were only taken into consideration if more than two households depended on them, otherwise, the data were considered insufficient.

**Table 8.4: Comparison of the food security scores averaged at the activity level in each village**

Activities	Wasini				Anzwani		Mkwiro			
	FCSI	Rank	STAI	Rank	FCSI	Rank	FCSI	Rank	STAI	Rank
Fishing	146.2	5	10	5	137.1	3	144.7	5	12.1	5
T.MNP	166.7	3	14	3	-	-	153	3	16	3
Tourism	177.7	1	-	-	173	1	-	-	-	-
Labour	-	-	-	-	-	-	-	-	-	-
Qualified	151.8	4	14	3	-	-	171.7	1	18	1
Other	169.7	2	15	1	127.2	4	165.2	2	16.5	2
Mixed	142.5	6	14.2	2	163.2	2	151.5	4	14.4	4

-: Insufficient data

As shown by table 8.4 when significant differences exist between the scores, the fishing households and the “mixed” households are worse off on average. This is the case in all three villages tested.

### 8.2.2 Variability within the “fishing” category

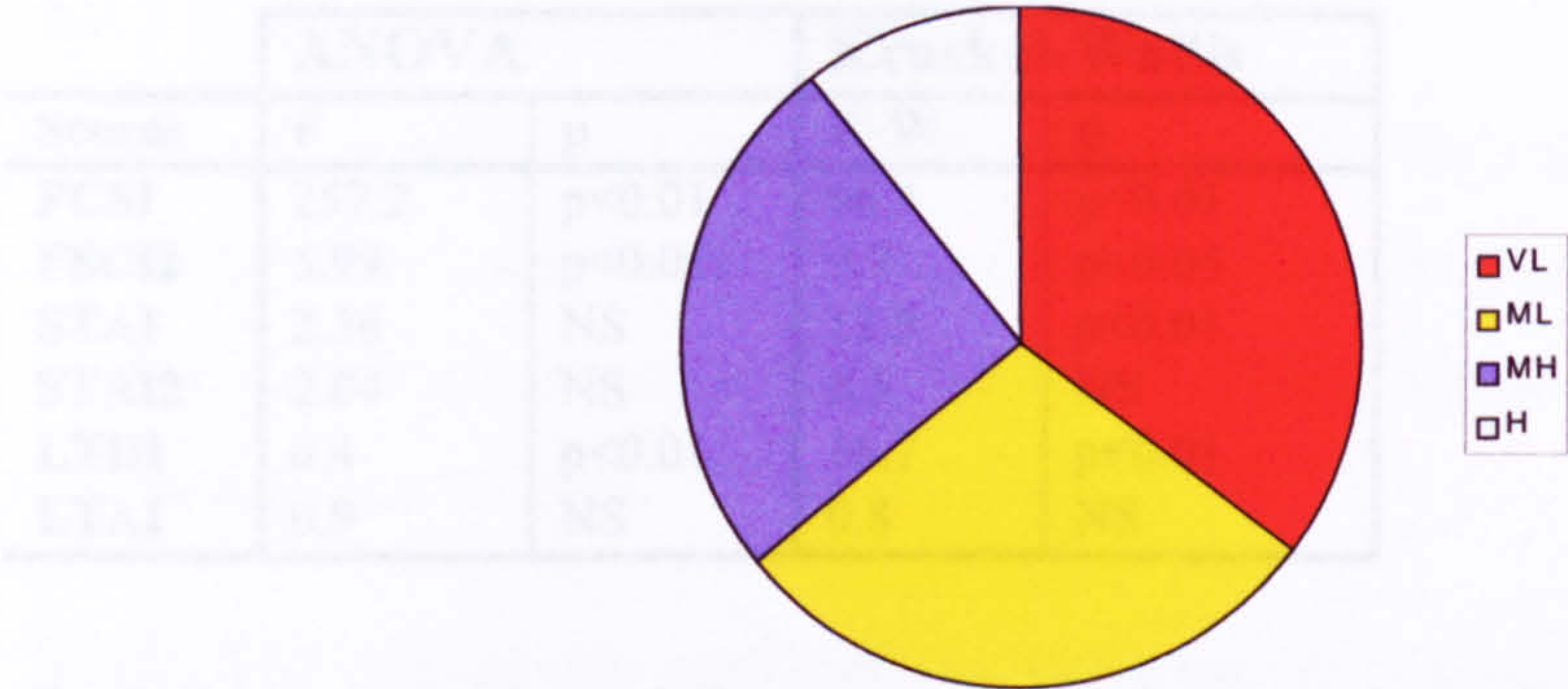
Half of the sampled households are predominantly fishing. The distribution of these households across the overall quartiles determined in the previous chapter was



The variability of the scores by quartile was estimated to compare the scores. The results of the ANOVA and Kruskal-Wallis tests are presented in table 8.4.

investigated (see fig. 8.1). The 210 surveyed households were divided into groups according to their short term food security (average of the STAI and the FCSI).

Table 8.4: Variability of the food security scores across the fishing groups



Both the parametric and the non-parametric tests show the same results except for

**Figure 8.1: The distribution of the fishing households across overall short term security groups**

As shown by the figure 8.1, significantly more than half (63.8%,  $p<0.01$ ) of the “fishing” households are found in the lower food secure groups (very low and medium low groups). However, 36.3% of them are more food secure in the short term than average. Figure 8.1 suggests that the fishing category is not homogenous and that the scores of fishing households vary.

Households predominantly depending on fishing were then divided into quartiles of their own, on the basis of the short term food security as was done in chapter 7. The first quartile corresponds to the very low food secure group and the fourth quartile to the higher food secure group. The average scores of each group are presented in the table 8.5.

**Table 8.5: Average food security scores of fishers’ groups controlling for short term food security**

Groups	FCSI	STAI	LTDI	LTAI	FCSI2	STAI2
VL	118.4	10.8	107.1	56.1	150.2	11.7
ML	135	11.5	113.2	55.2	167.1	12.5
MH	150.4	11.9	120	61.6	164.1	13
H	167	12.6	126	56.1	169.1	13.8
All	142	11.7	116.3	57.3	161.4	12.6



The variability of the scores by quartile was examined to compare the scores. The results of the ANOVA and Kruskal-Wallis tests are presented in table 8.6.

**Table 8.6: Variability of the food security scores across the fishers groups**

Scores	ANOVA		Kruskal-Wallis	
	F	p	K-W	p
FCSI	257.2	p<0.01	96.3	p<0.01
FSCI2	5.99	p<0.01	9.7	p<0.05
STAI	2.36	NS	12.5	p<0.01
STAI2	2.04	NS	6.5	NS
LTDI	6.4	p<0.01	16.7	p<0.01
LTAI	0.9	NS	0.8	NS

Both the parametric and the non-parametric tests show the same results except for the STAI. Thus, the FCSI, FSCI2 and the LTDI can be confidently considered as significantly different across the determined quartiles.

These results suggest that the scores of fishing households are not homogenous. The aim of this chapter is to determine the causes of this variability in scores. The influence of demography, geography, land uses and fishing systems on the scores are investigated in the following section.

### 8.3 FISHING AND THE KMNP

The aim of this section is to investigate whether the KMNP is part of the source of the variability in fishing households' food security. First, the potential influences of the demographic parameters, subsistence agriculture, and of the characteristics of the fishing systems are examined. If any effects were detected, they would have to be taken into consideration when interpreting the results of the study of the effects of the KMNP on the scores.



8.3.1 Demography and land use parameters

8.3.1.1 Demographic parameters

The relations between demographic parameters and fishing households scores were investigated by using Pearson’s correlation coefficients. The calculations were based on the matrix composed of the individual scores, household size and number of dependants (i.e. n=100).

**Table 8.7: Significant correlations between the demographic parameters and the food security scores of fishing households at the individual level**

Score	Household size	Number of dependents
STAI	-0.261	-0.301

*n=100, r<sub>critic.</sub>=0.199 for α=0.05, r<sub>m</sub>= 0.599 /*

As shown in table 8.7, the only significant correlations are between both demographic parameters and the short term accumulation scores. They are both negative but weak (see section 8.1.2.2.). Only one score is involved. Thus, the influence of the demographic parameters on the variability of the scores is suspected to be limited.

Furthermore, no significant differences in the household sizes or in the number of dependants were detected across fishers groups (short term food security groups) or across villages. Both the ANOVA and the Kruskal-Wallis showed the same results (p>0.05).

8.3.1.2 Subsistence agriculture

Subsistence agriculture is often part of fishers’ production systems. This was found to be the case in Diani where very few fishing households depended on fishing for 100% of their livelihood (Malleret-King, 1996). Furthermore, as was mentioned



previously (section 7.4.2), 70% of the households cultivating either gardens or fields were also mainly dependent on fishing.

It was suspected that subsistence agriculture could explain some of the variability in fishing households' scores. To test this, two sample t-tests were carried out (Argyrous, 1997). These were used to compare the scores of the households cultivating gardens or fields and those not cultivating at the individual level.

**Table 8.8: Comparison of the average food security scores of cultivating (gardens or fields) and non-cultivating fishing households**

Scores	Gardens				Fields			
	T-test		Means		T-test		Means	
	tscore	p	Yes	No	tscore	p	Yes	No
STAI	1.1	NS	-	-	-0.5	NS	-	-
LTDI	0.8	NS	-	-	-2.4	p<0.05	113.6	122.1
FCSI2	-3.2	p<0.01	168.4	156.6	1.79	NS	-	-
STAI2	-2.07	p<0.05	13.4	12.1	-0.02	NS	-	-

Results presented in table 8.8 show that, at the individual level, few of the scores are affected by the cultivation of gardens or of fields.

Surprisingly, this time, fishing households cultivating fields are worse off in terms of long term divestment (LTDI). However, it is unlikely that the cultivation of fields would have a direct negative impact in the long term. An explanation for this result could be that most of the fishing households cultivating fields are located in one village which represents only one type of production system. 90.3% of fishing households cultivating fields are located in Kibuyuni. The negative influence could thus be coming from another source. In order to analyse whether these results are due to a large influence of one location, a t-test was carried at an individual level for each village.

More expected is the positive impact that cultivating gardens has on the scores of the second round (see table 8.8). This could confirm the suspicion expressed in section 7.4.2 that the direct effect of having a garden was unlikely to be negative (e.g. hardly any costs are associated with a garden). However, two explanations could be given for the potential positive influence. On the one hand, the small production of the



gardens (fruit, vegetables and small amount of maize or cassava) might have had time to be harvested before the torrential rain of October (see chapter 6) or some of these varied productions might not have been affected strongly by the torrential rains. Thus, households with gardens were better off in the second round than the ones without gardens. In the first round, the crops were not ready therefore no difference could be expected.

On the other hand however, the significant differences in the scores could be explained by the strong influence of one location (i.e. 72.4% of the households with gardens are located in Anzwani). Moreover, in the second round, the researchers' bias is suspected to be strong in Anzwani, which could also explain such a large difference between the first and second round. Thus, the high level of the scores in the second round of Anzwani (see section 7.2.2 ) might have influenced the results shown in table 8.8.

In order to detect whether the results presented in table 8.8 are biased by an uneven distribution of the households with gardens and with fields, the two sample t-test was performed in each village separately.

No significant differences were found between fishing households with fields and those without fields in the villages separately. The negative impact is thus thought to be a result of the bias of the distribution of the households with fields. Other parameters are suspected to influence the scores.

**Table 8.9: Significant differences detected in the villages separately between households cultivating gardens and households not cultivating gardens**

Kichangani	Scores	T-test		Means	
		tscore	p	Yes	No
	FCSI2	-2.743	p<0.05	161	130

However, as shown in table 8.9, a significant difference was found in Kichangani where households with gardens are significantly better off in terms of coping strategy use in the second round than the others. This result suggests that the productions of gardens might not have been affected by the extreme conditions due



to El Niño and that they have boosted the food security of the households in the short term in the second round. This difference was not observed in any other village or in Anzwani where 65.6% of the household have a garden. Thus, caution must be applied to this interpretation of the results.

The results of the t-test suggest that the cultivation of a garden might have had an effect on the food security in the second round. In order to confirm this result, Pearson's correlation coefficients were calculated based on the scores averaged at fishers' group level and on the percentage of the households with gardens in each group (n=5: the four groups and the overall mean). However, no significant correlations between the scores and the percentage of households with gardens ( $r_{critic.}=0.849$  for a probability of 5%). Thus, although the potential influence of the gardens on the second round scores have to be kept in mind, it is unlikely to be a strong source of variability.

### **8.3.2 Components of the fishing systems**

Production systems are characterised by the types of activities carried out by the households but also by the organisation of these activities in terms of capital and labour (see Malleret-King, 1996). For example, in terms of fishery, the gear used, the use of boats and the ownership of boats could affect the income and the food security. In the study sites, parameters linked to the fishing systems identified as likely to affect the scores of the fishing households were the use of boats, the ownership of boats and the participation in the shift (use of a powered boat given by KWS). To investigate whether these parameters had an influence on the scores, two sample t-tests were carried out on the individual scores (table 8.10).



**Table 8.10 : Significant differences in the food security scores according to the components of the households’ fishing system**

Scores	Shifts		Boat use		Boat ownership	
	tscore	p	tscore	p	tscore	p
<b>LTDI</b> <sub>N=105</sub>	-2.8	p<0.01	-0.2	NS	-0.7	NS
<b>LTAI</b> <sub>N=105</sub>	1.2	NS	-0.1	NS	-3.11	p<0.01
<b>FCSI2</b> <sub>N=67</sub>	-0.2	NS	-2.2	p<0.05	-0.7	NS
<b>STAI2</b> <sub>N=67</sub>	-1	NS	-2.3	p<0.05	0.1	NS

**Table 8.11: Comparison of the average food security scores of the fishing households when significant differences were detected**

Scores	Shifts		Boat use		Boat ownership	
	Yes	No	Yes	No	Yes	No
<b>LTDI</b> <sub>N=105</sub>	124.7	114.3	-	-	-	-
<b>LTAI</b> <sub>N=105</sub>	-	-	-	-	63.4	53.2
<b>FCSI2</b> <sub>N=67</sub>	-	-	164.3	152.8	-	-
<b>STAI2</b> <sub>N=67</sub>	-	-	12.98	11.4	-	-

The results presented in tables 8.10 and 8.11 show that in the second round, households using a boat are better off in the short term than the others. They also show that participating in the shifts could have a positive influence on the long term divestment index (LTDI) and that households owning at least one boat are better off than the others in terms of long term accumulation (LTAI).

The fact that households using boats are better off than others is not surprising. The surprise comes from the fact that the difference does not appear in the first round. An explanation for this could be that during the SE monsoon (the rainy period) fishers with boats stay nearshore and a lot of fishers with or without boats use tidal weirs. Thus, reducing the difference. On the other hand, during the NE monsoon, when the winds are more appropriate and the weather better, boats can go further off shore into more productive areas whilst the use of tidal weirs stops. However, another explanation could come from a bias in the second round. One of the villages is not taken into consideration and the results of Anzwani are dubious (see chapter 6).



Tables 8.10 and 8.11 also show that in the long run, households owning a boat have a better accumulation capacity. This result would be expected as the households' capacity to buy material and boats (included in the best strategy perceived, see 6.2.2.2) is taken into consideration in the calculation of the LTAI. Thus, ownership of a boat could indicate a higher LTAI. At one stage the households have been able to accumulate enough to buy a boat or buy the material necessary to make a boat. This result expresses however more the fact that the households had a better accumulation capacity and bought a boat rather than the boat ownership influencing the LTAI.

Finally, households participating in the shift are significantly better off in terms of long term divestment than the others (tables 8.10 and 8.11). This means that they have been faced with less severe crises or that they have coped better in the last ten years. An explanation could be that working on larger and powered boats, the fishers are less affected by the weather and not dependent on the wind. They have therefore more opportunities to fish in the productive offshore areas more regularly. However, the shifts mainly concern the two villages of Mkwiro and Kibuyuni. The difference could also have other explanations than the shifts.

In order to investigate further whether using a boat, participating in the shifts and owning a boat have direct influences, t-tests were performed for the individual households but for each village separately.

**Table 8.12: Significant differences in the food linked to components of the fishing system for each village**

Village	scores	Owning a boat				Using a boat			
		t-test		Means		t-test		Means	
		tscore	p	Yes	No	tscore	p	Yes	No
Kichangani	FCSI	-2.44	p<0.05	143	119	-2.44	p<0.05	143	119.4
Kibuyuni	FCSI	-3.4	p<0.01	161.4	142.7	-	-	-	-
	LTAI	-3.2	p<0.05	62.7	50.4	-	-	-	-

At the village level, no significant differences were detected between the scores of the households participating in the shifts and others. This could indicate that the



LTDI is influenced more by parameters linked to the location of the villages where shifts exist rather than directly by participation in the shifts.

On the other hand, table 8.12 shows that in Kibuyuni, households owning a boat are significantly better off than others in terms of coping capacities in the short term and in terms of accumulation in the long term. In Kichangani, households using a boat are better off than ones not using a boat in terms of the FCSI. However, no differences in the second round were detected. This could suggest that another factor influenced the second round.

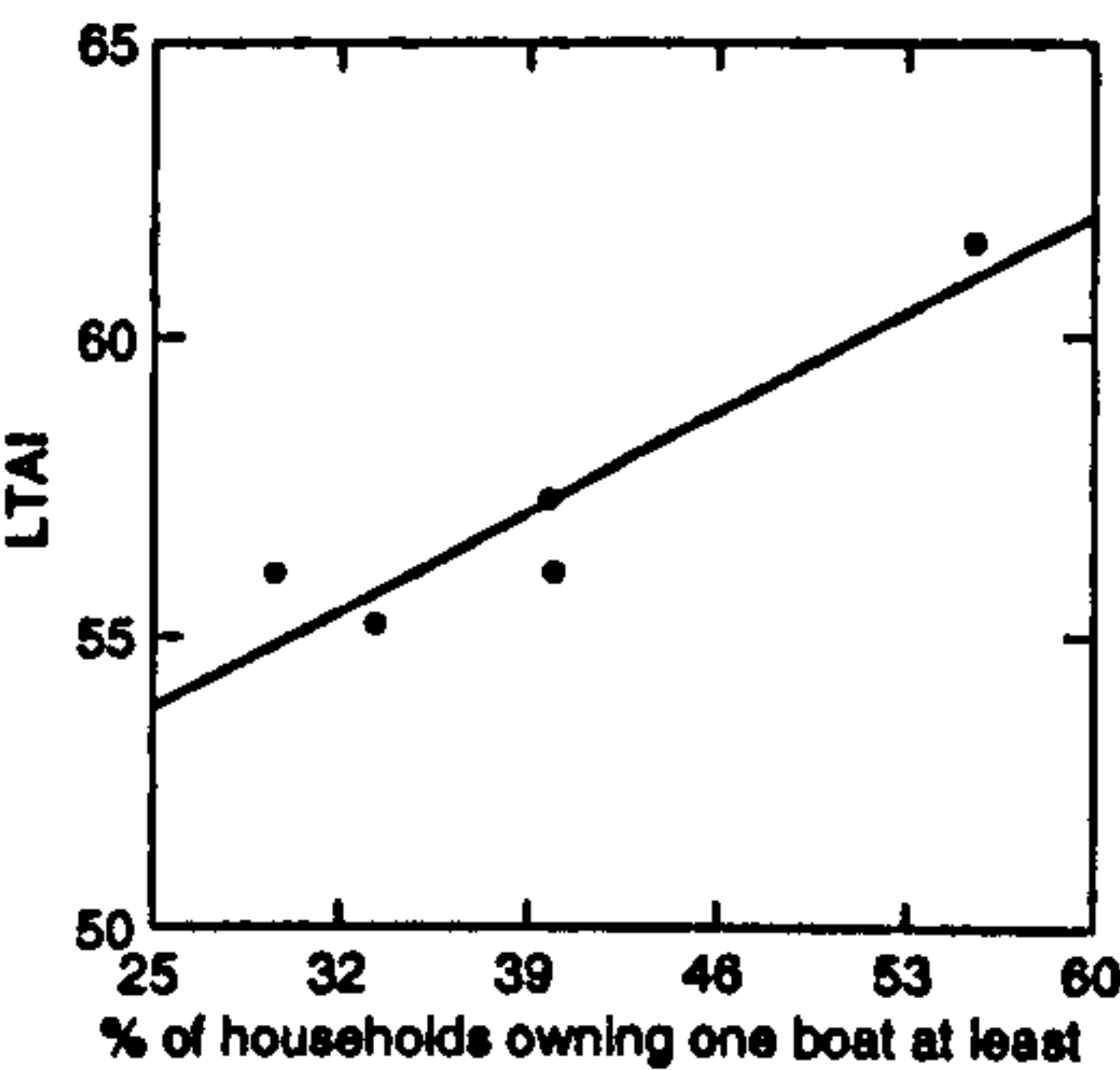
Again the influence of the characteristics of the fishery are not clear. To complement and support the information from t-tests, Pearson's correlation coefficients were calculated based on the data averaged at the fishers' groups (i.e. quartile level). The only significant correlation found was the one presented in table 8.13.

**Table 8.13: Significant Pearson's correlation coefficient between the food security scores and the components of the fishing systems**

Score	Owning a boat
LTAI	0.927

*n=5,  $r_{critic}=0.849$  for  $\alpha=0.05$ ,  $r_m=0.883$  /*

No significant correlation was found between the characteristics and the scores except for a strong positive correlation between the LTAI and the ownership of boats.



**Figure 8.2: correlation between the LTAI and boat ownership aggregated at the group level**



Thus, it is likely that owning a boat has a strong part in indicating a high LTAI in the case of fishing households (see figure 8.2). For the other parameters, no correlations were found. However, the impact of using a boat on the household food security in the second round has to be kept in mind when interpreting further results.

### 8.3.3 Geographic parameters

The most likely effects of the KMNP on the scores of the fishing households were thought to occur through the distance of the households (aggregated at the village level) from the KMNP or the Reserve. The analysis carried out in sections 8.3.1 and 8.3.2 shows that some of the identified parameters have a potential influence on the scores but the causality could not be established for all of them. However, the sign of their suspected influence had to be taken into consideration in the following analysis.

#### 8.3.3.1 Distance from the KMNP and the Reserve

As suggested in the previous chapter, the distance of the villages from the KMNP or the Reserve were thought to have a potential effect on the households food security. Section 7.3.2 showed that the distance of the villages from the KMNP was negatively correlated with the short and long term accumulation scores (respectively -0.891 and -0.835). It also showed that there was a significant negative correlation between the distance from the Reserve and the LTAI. However, these results are thought to be affected by other parameters as well, such as the economic activities.

The expected direct effects of the KMNP would be that the nearer the households to the KMNP, the more food secure they are. In order to investigate the relationship between the KMNP, the Reserve and the scores of the fishing households, Pearsons' correlation coefficients were calculated (table 8.15). The calculations were based on the data averaged at the group level, and the overall average (table 8.14).



**Table 8.14: Food security Scores and distances averaged at the fisher group level**

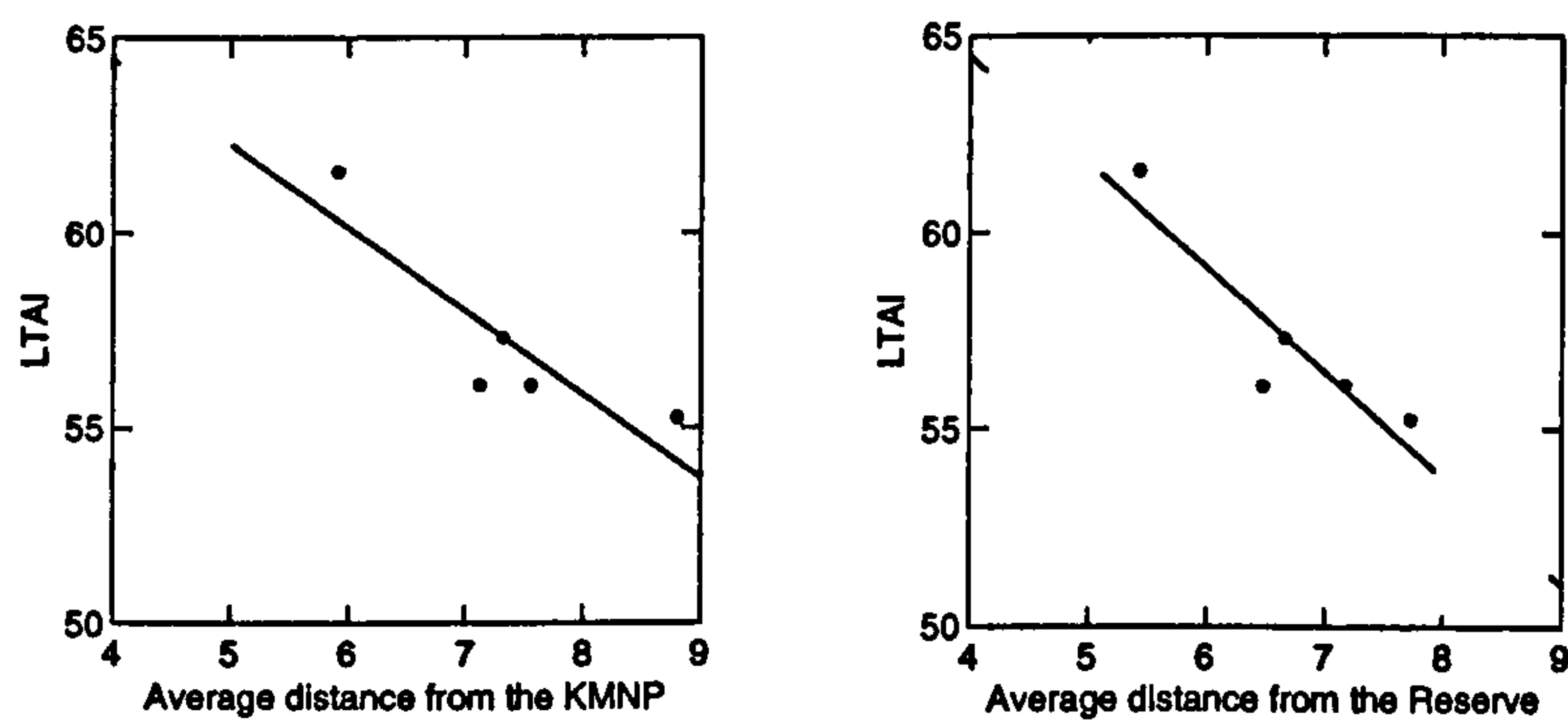
Group	FCSI	STAI	LTDI	LTAI	FCSI2	STAI2	KMNP (km)	Reserve (km)
VL	118.4	10.8	107.1	56.1	150.2	11.7	7.57	6.48
ML	135	11.5	113.2	55.2	167.1	12.5	8.81	7.73
MH	150.4	11.9	120	61.6	164.1	13	5.93	5.44
H	167	12.6	126	56.1	169.1	13.8	7.13	7.18
All	142	11.7	116.3	57.3	161.4	12.6	7.33	6.67

**Table 8.15: Significant Pearson’s correlations between the food security scores and the distance from the KMNP and the Reserve averaged at the group level**

Scores	KMNP (km)	Reserve (km)
LTAI	-0.874	-0.907

$n=5, r_{critic}=0.849$  for  $\alpha=0.05, r_m=|0.883|$

Table 8.15 shows that the only score averaged at the group level significantly correlated with the distances is the long term accumulation index (LTAI). The correlation is particularly strongly negative ( $|r|>|0.883|$ ) with the distance from the Reserve (see figure 8.3).



**Figure 8.3: Correlations between the LTAI and the distances in km from the KMNP and from the Reserve averaged at the fisher group level**

Thus, the further away from the KMNP or the Reserve the less accumulation capacity in the long term. The results presented in table 8.14 partly confirm at the fisher group level what was found at the overall level in the chapter 7 (see table



7.19). The reason for this could be a progressive improvement of the catch for the fishers living nearer the KMNP or nearer the Reserve (Wasini and Mkwiro).

However, it was found in section 8.3.2 that ownership of boats positively affected the LTAI. This could bias the LTAI results above (table 8.15) and be a reflection of the differences in fishing systems between villages rather than of a direct influence of the distances. To test this, the boat ownership parameter was taken into consideration and the households were divided into two sub-groups; fishing households owning at least one boat and the others. This was done to investigate whether distances were still a cause for variability when boat ownership was taken into account. Using an ANOVA and a Kruskal-Wallis one way analysis of variance, the LTAI variability of “boat owners” according to the distances was investigated at the individual level. This test showed that there was no significant variation of the boat owners’ LTAI in relation the distances of the households from the KMNP or the Reserve ( $p>0.05$ ). The results of both tests were similar.

The variability of “non boat owners” LTAI was investigated in a similar way. The results showed that there was a significant variation of the LTAI of non boat owners in relation to the distances from the KMNP and the Reserve ( $p<0.01$  for both with the ANOVA and  $p<0.05$  for the Kruskal-Wallis test). Because the distances were only calculated at the village level, the scores and other characteristics of non boat owners (62 households) were aggregated at the fishers group level (see appendix 8). Pearson correlation coefficients were calculated in order to identify whether a correlations could be detected between the average LTAI and the average distances. These are presented in table 8.16.

**Table 8.16: Correlations between non boat owners' LTAI and distances from the KMNP and the Reserve averaged at the fishers group level**

Parameters	KMNP (km)	Reserve (km)
LTAI (non owners)	0.850	0.535

$n=5$ ,  $r_{critic.}=0.849$  for  $\alpha=0.05$ ,  $r_m=0.883$  /



The correlation between the LTAI of households without boats and the distance from the KMNP is very weakly positive. In addition, no significant correlation was found with the distance from the Reserve. Using t-tests at the individual level demonstrated that households owning at least one boat had a significantly greater LTAI than the others ( $p < 0.05$ ) but the distances do not affect strongly the LTAI scores when the households are separated into sub-groups (owners and non owners). Thus, it is suspected that the strong influence of the distance on the fishing households' LTAI is not directly due to distances. Thus, no conclusions can be drawn on the factor influencing most the fishing households' LTAI. It seems unlikely that the distances from the KMNP or from the Reserve are the only parameters affecting the scores.

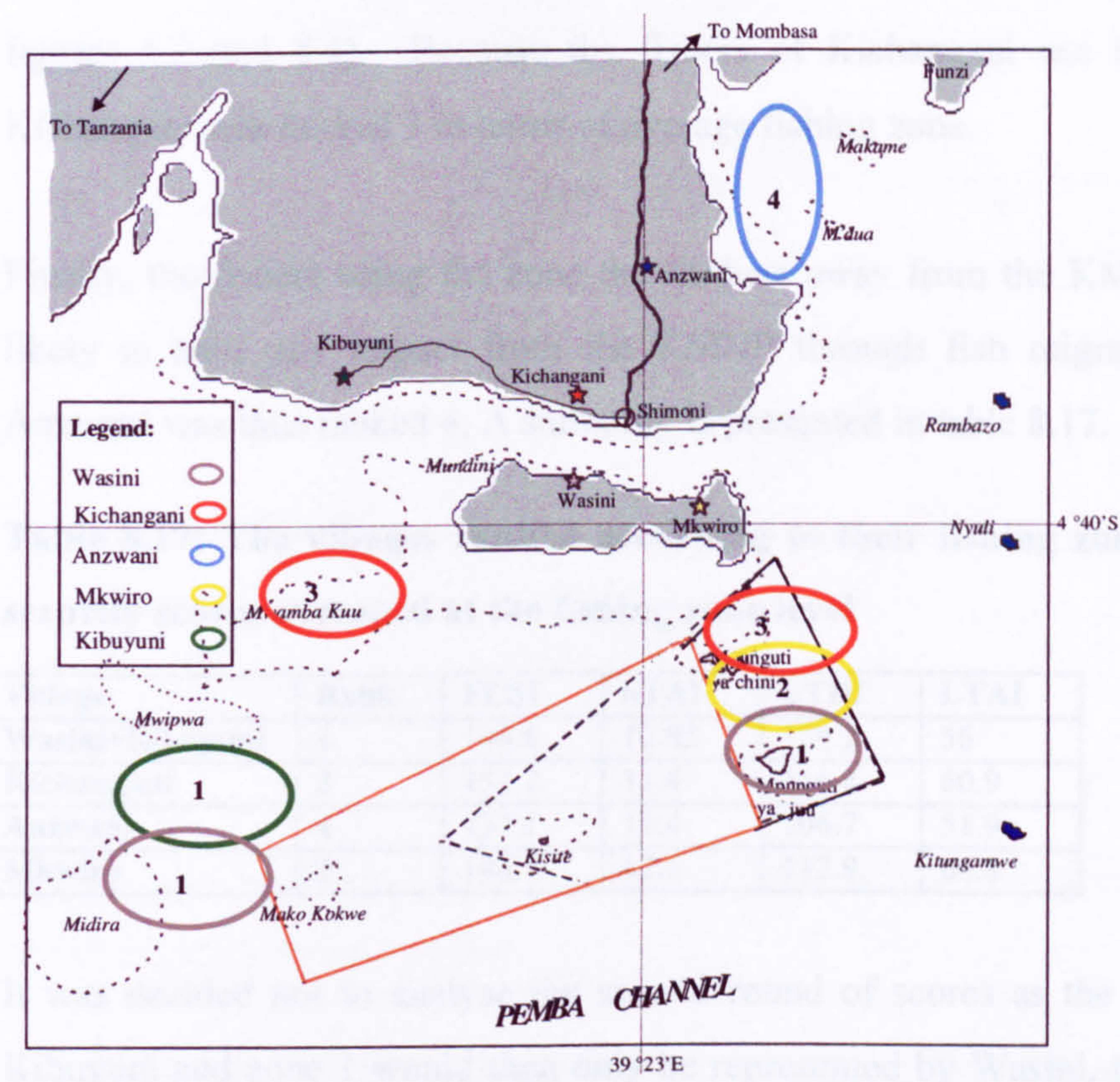
However, as discussed in the chapter 7, the shortest distances of the villages from the KMNP and Reserve are more an indication of the fishers' accessibility to fishing grounds located near the KMNP. These distances do not represent the shortest routes taken by the fishers which are affected by the tides and the wind, nor do they reflect the real fishing areas used by fishers. This might have introduced a bias in these results.

#### **8.3.3.2 Distances and fishing zones**

One of the reasons why fish migration from the Kisite Marine National Park could not be detected was believed to be the patchiness of the coral reef (Watson, 1996). Most of the commercial fish species exploited in the area are demersal and rely on the presence of a reef-associated ecosystem. However, it was estimated that the minimum distance between the exploited reefs of the Reserve and the protected reefs (i.e. in the KMNP) was 1.7 km (Anon., 1993). Although this distance is within the range of some commercial species studied by Watson (1996) it was thought that the sandy substrate between the reefs acted as a deterrent and prevented fish which fed on seagrass or coral from migrating out of the KMNP (Watson, 1996). A similar explanation was suggested by Rakitin and Kramer (1996) when the migration of fish outside an MPA in Barbados could not be proved.



It was thus thought that the likely effects of the KMNP on the surrounding fishery could better be detected if the fishing zones as well as their proximity to protected reefs were taken into consideration. The villages main fishing zone during the SE monsoon were discussed in the focus groups (see chapter 5, fig. 5.5). The results of these discussions allowed four fishing zones to be identified and ranked according to their proximity to a protected reef and to the boundaries. The ranks also take account of other zones used by the villages in the same season (fig. 8.4).



**Figure 8.4: Fishing zones used by the fishers ranked according to their average proximity to the KMNP protected reefs.**

Zone 1 corresponds to one of the main zones used by Wasini and Kibuyuni fishers (Midira) on the southern border of the KMNP (chapter 5). A few hundred meters from the Midira is located another small reef, itself within 1 km of Mako Kokwe which is protected. Wasini fishers also use the Reserve which gives access to the northern border of the KMNP, and were still considered as fishing in zone 1 as both



zones are in the vicinity of the KMNP. Mkwiro fishers mainly use the Reserve in both monsoons (see fig. 5.5). Although the Reserve is very near the northern boundary of the KMNP it is further away from the protected reef of Kisite than Midira is from Mako Kokwe. Mkwiro was ranked 2 in terms of average fishing zone.

Although part of Kichangani fishers use the Reserve during the SE monsoon, they also fish in the southern border of Wasini Island (Mwambakuu) which is further away than the two other zones from the KMNP border and the protected reef (see figures 5.5 and 8.4). Because the fishers of Kichangani use both these zones, Kichangani was ranked 3 in terms of average fishing zone.

Finally, the fishers using the zone the furthest away from the KMNP and the least likely to have any impact from the KMNP through fish migration is Anzwani. Anzwani was thus ranked 4. A summary is presented in table 8.17.

**Table 8.17: The villages ranked according to their fishing zones and the food security scores averaged at the fishing zone level**

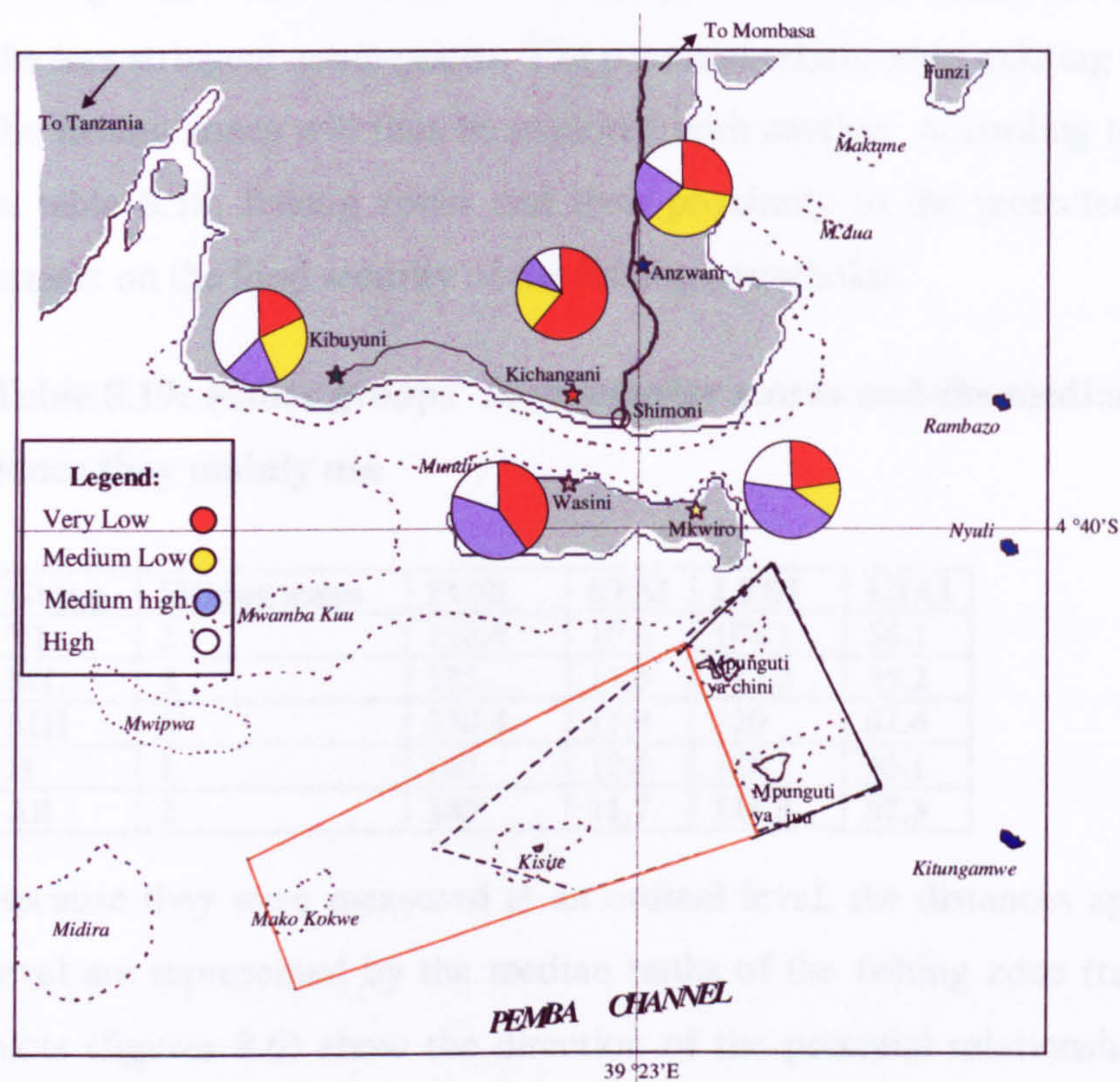
Village	Rank	FCSI	STAI	LTDI	LTAI
Wasini+Kibuyuni	1	146.8	10.95	129.2	56
Kichangani	3	131.2	11.4	116.4	60.9
Anzwani	4	137.1	11.4	106.7	51.9
Mkwiro	2	144.7	12.1	112.9	66.8

It was decided not to analyse the second round of scores as the surveys failed in Kibuyuni and zone 1 would then only be represented by Wasini, thus introducing a bias in the comparison of the scores.

Figure 8.5 illustrates the fact that the KMNP might have a positive effect on the fishing households according to their fishing zones. It suggests that the fishing households' food security could vary with the fishing zones they have access to. For example, the villages included in zone 1 have more than half of their fishing households more food secure in the short term than average (Wasini and Kibuyuni).



In contrast, the villages corresponding to zones 3 and 4 have more than half of their fishing households less food secure than the average (Kichangani, Anzwani).



**Figure 8.5: Distribution of the fishing households across the short term food security group in each village**

The ANOVAs and the Kruskal-Wallis one way analysis of variance were used to investigate the likely effects of the KMNP in relation to the fishing zones and their proximity to the protected reefs. The results are shown in table 8.18.

**Table 8.18: Difference in the food security scores according to the fishing zones**

Scores	ANOVA		Kruskal-Wallis	
	F	p	K-W	p
FCSI <sub>N=105</sub>	2.9	p<0.05	7.32	p=0.06
STAI <sub>N=105</sub>	0.376	NS	2.02	NS
LTDI <sub>N=100</sub>	8.44	p<0.01	19.87	p<0.01
LTAI <sub>N=102</sub>	6	p<0.01	16.34	p<0.01

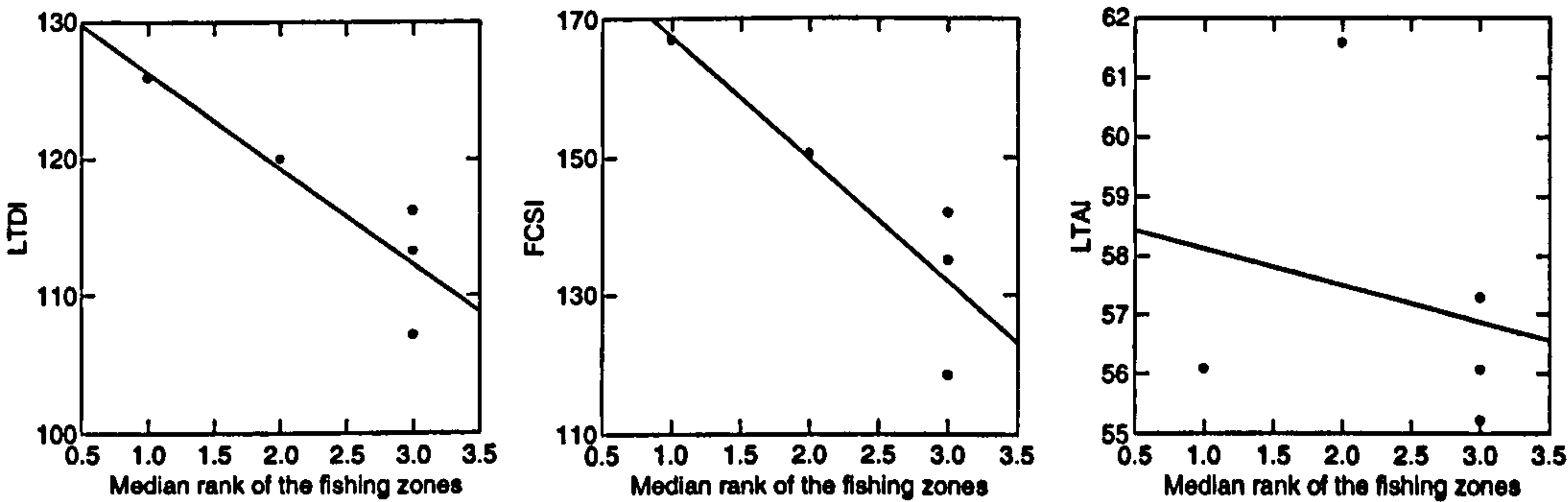


According to the parametric test (ANOVA), fishing households' long term scores (LTDI and LTAI) and their short term coping capacity (FCSI) vary significantly with the fishing zones. The Kruskal-Wallis test gives the same results except for the FCSI due to the less stringent assumptions. The potential relationship existing between the FCSI and the fishing zones will thus be explored with caution. According to the results presented in table 8.18, fishing zones and their proximity to the protected reefs might have an impact on the food security of the fishing households.

**Table 8.19: Fisher groups' food security scores and the median ranks of the fishing zones they mainly use**

Group	Fishing zones	FCSI	STAI	LTDI	LTAI
VL	3	118.4	10.8	107.1	56.1
ML	3	135	11.5	113.2	55.2
MH	2	150.4	11.9	120	61.6
H	1	167	12.6	126	56.1
All	2	142	11.7	116.3	57.3

Because they were measured at an ordinal level, the distances aggregated at the group level are represented by the median ranks of the fishing zone (table 8.19). The scatter plots (figures 8.6) show the direction of the potential relationship between the scores aggregated at the fishers group level.



**Figure 8.6: variation of the FCSI, LTDI and LTAI in relation to the rank of the fishing zones aggregated at the fisher group level**

Figure 8.6 suggests that, although there is a significant difference of the fishers' LTAI according to the fishing zones, no clear relationship is detected (negative or



positive). Other factors than distance from the protected reef might contribute to the variability such as the boat ownership (section 8.3.1).

On the other hand, the graphs show that the distance from the protected reefs possibly affects negatively the food security in the short term (FCSI) and the long term divestment index (LTDI). Spearman's rank order correlation coefficients were calculated and showed negative associations between the LTDI, FCSI averaged at the fisher group level and the corresponding median rank of the fishing zones (respectively -0.894 and -0.894 for  $n=5$ ). Thus, the further away from the nearest protected reef, the less food secure in the short term during the SE monsoon and the less coping capacity in the long run.

No other parameters (see sections 8.3.1 and 8.3.2) are suspected to affect the fishing households' FCSI in the first round. The potential negative association between the fishing zones' median ranks and the scores could be a direct effect from the presence of the KMNP through its protected reefs.

On the other hand, the LTDI was previously found to vary with other parameters. The cultivation of fields is likely to indicate a lower LTDI and the participation in shifts is likely to indicate a higher LTDI (see sections 8.3.1 and 8.3.2).

A way in which to take account of the confounding variables and investigate the relationship between the LTDI and the fishing zones ranked according to their proximity to protected reefs was to separate the fishing households into sub-groups according to their characteristics; participation in the shifts ( $S_1$  if yes and  $S_0$  if not) and cultivation of fields ( $F_1$  if yes and  $F_0$  if not).

90% of the fishing households cultivating, exploit zone 1. The cultivation of fields indicates lower LTDI thus would counteract the suspected positive effects of the protected reefs' proximity (the nearer the protected reef, the greater the LTDI). The main concern comes from the participation in the shifts. This parameter is suspected to affect positively the fishing households' LTDI. Fishing households participating



in shifts are located for 70% in zone 1 and 30% in zone 2. Thus, this parameter could, if strong, contribute and accentuate (up to significance) the decreasing trend of the LTDI according to the fishing zone.

Using ANOVAs and Kruskal-Wallis one way analysis of variance, the variability of the LTDI in relation to the fishing zones was investigated for each sub-group to find out if the distance from the protected reefs played a predominant role.

**Table 8.20: Variability of the LTDI with the fishing zone for each sub-group**

Sub-groups	ANOVA		Kruskal-Wallis	
	F	p	K-W	p
<b>F<sub>0</sub> N=69</b>	4.72	p<0.01	12.99	p<0.01
<b>S<sub>0</sub> N=81</b>	5.98	p<0.01	14.78	p<0.01
<b>F<sub>1</sub> N=30</b>	5.04	p<0.05	5.02	NS
<b>S<sub>1</sub> N=19</b>	3.6	NS	4.05	NS
<b>(F<sub>0</sub>;S<sub>0</sub>)* N=60</b>	3.70	p<0.01	10.04	p<0.05
<b>(F<sub>1</sub>;S<sub>1</sub>)N=10</b>	-	NS	-	NS

\* (F<sub>1</sub>;S<sub>1</sub>) : fishing households cultivating fields and with members participating in the shift  
(F<sub>0</sub>;S<sub>0</sub>) : fishing households not cultivating fields and with no members participating in the shift.

When the participation in shifts is taken into consideration (S<sub>1</sub>), no significant variation can be detected (p>0.05). Similarly, no significant variations of the sub-group (F<sub>1</sub>;S<sub>1</sub>) composed of fishing households cultivating fields and participating in the shifts (p>0.05) was found. This was due to the fact that 100% the households of this sub-group fish in the zone 1.

According to the results presented in table 8.20, when the cultivation of fields is taken into consideration (F<sub>1</sub>) the variation of the LTDI is significant. This was not confirmed by the non-parametric test thus should be examined with caution. The LTDI averaged at the fishing zones decreased with the distance to the protected reef but this trend was not obvious when the data were aggregated at the fisher group level (Spearman’s correlation coefficient: -0.447, see table 8.21).



However, a strong variability of the LTDI was found for the sub-groups ( $F_0$ ) and ( $S_0$ ), meaning that when households cultivating fields are not taken into consideration or when households participating in the shifts are not taken into consideration, the variability still exists. Similarly, the 60% of fishing households belonging to the sub-group which did not cultivate fields and did not participate in the shifts ( $F_0;S_0$ ) is shown to vary significantly with the fishing zones. Furthermore, when the data are aggregated at the fisher group level, negative associations are detected using Spearman's rank order correlation coefficients (table 8.21).

**Table 8.21: Associations between the fishing zones' median rank and the LTDI scores averaged at the fisher group level for each sub-group**

Sub-groups	Spearman's rho at the fisher group level (n=5)
( $F_0$ )	- 0.791
( $S_0$ )	- 0.783
( $F_1$ )	- 0.447
( $F_0;S_0$ )	- 0.72
All	- 0.894

When the two main elements of variability other than fishing zones are eliminated from the data (i.e. by selecting sub-groups of the fishing household population), significant variations of the LTDI according to the distance from the protected reef are found and the associations, when detected, are negative. Thus, the further away the household can fish from the nearest protected reef, the lower its coping capacities in the long term is.

Although significant variations could not be found for all the sub-groups, the ones which were found reflected a negative relationship between the LTDI and the distance from the protected reefs. The results presented above could suggest that proximity of the fishing zones to the protected reef is likely to have a predominant benefit on the short term and long term food security for most fishing households.

Midira and surrounding reefs are located within 1km of the protected reef of Mako Kokwe. Results found in this section could reflect the direct benefits of the KMNP on the surrounding fishery. It also shows that these effects are restricted by distance



as other studies have found (Roberts and Polunin, 1991, DeMartini, 1993, Russ and Alcala, 1996a, 1996b).

An explanation for the better situation of fishers exploiting the Midira zone could be that it always has been a more productive fishing zone than the others. However, all the fishers interviewed mentioned that Kisite and Mako Kokwe were their best fishing spots when they were not protected (see chapter 5). Thus, the better situation of the zone 1 fishers could be directly due to the “spill over” effects of Mako Kokwe (fig. 8.4). Moreover, the potential effects detected of the KMNP on the fishery confirm Kibuyuni’s fishers’ opinion. In the focus groups aimed at identifying the perceived benefits and drawbacks of the KMNP, one of the advantages only mentioned by the fishers of Kibuyuni was an increase of the size of the fish caught (chapter 5). However, in order to establish a more precise link between the proximity of the protected reefs and the socio-economic situation of the fishing households, it would be necessary to study the precise fishing spots fishers use throughout the year.

## **8.4 CONCLUSIONS**

The economic activity on which the households depend significantly affects their short term food security (STAI and FCSI). The fishing households were found to be the least food secure. This pattern was also identified when the situation of individual households was analysed in each village separately. To analyse further their food security situation, the fishing households were divided into four groups. This demonstrated that some of these households were significantly better off than others. The aim was then to determine whether the KMNP had a direct role in this variability.

Two sample t-tests, Pearson’s correlation coefficients, Spearman’s rank order correlation coefficients, ANOVAs and Kruskal-Wallis tests were used to study the



links between the fishing households’ food security and parameters such as demography, land uses, components of fishing systems, location of villages and of fishing zones. Tables 8.22 and 8.23 summarise the results of this analysis.

In addition, tables 8.22 and 8.23 present a measure of the strength of the indicators used in the analysis of the surveys. The aim, as explained in chapter 7, is to identify the most explanatory indices, the ones which provide the most information on the households. The strength is measured by adding the scores associated to the detected relationship between an index and an identified parameter. Thus, a significant correlation gets a score of 0.5, a correlation considered as strong gets a score of 1, and a potential relationship (detected by the non-parametric test but not confirmed by a t-test) gets a score of 0.25.

**Table 8.22: Sign of the suspected effects of identified parameters not linked to the KMNP on the fishing households’ food security, and indices' strength scores**

Scores	Gardens	Fields	Shifts	Using boat	Owning boat	Indices strength scores*
LTDI	o	- <sub>p</sub>	+ <sub>p</sub>	o	o	0.5
LTAI	o	o	o	o	+	0.5
FCSI2	+ <sub>p</sub>	o	o	+ <sub>p</sub>	o	0.5
STAI2	+ <sub>p</sub>	o	o	+ <sub>p</sub>	o	0.5

*+<sub>p</sub>: significant t-test and significant correlation found, -<sub>p</sub>: potentially negative, +<sub>p</sub>: potentially positive, o: none*  
*\*o: scores 0, -<sub>p</sub> or +<sub>p</sub>: score 0.25, - or +: score 0.5. The strength score was calculated by adding the values associated to each correlation.*

**Table 8.23: Identified links between KMNP-related parameters and the fishing households’ food security, and indices' strength scores**

Scores	K MNP (km)	Reserve (km)	Fishing zones	Shifts (t-test)*	Indices strength scores*
FCSI	o	o	-	o	0.5
LTDI	o	o	--	+ <sub>p</sub>	1.25
LTAI	-	--	o	o	1.5

*--: strong negative correlation, -: significantly negative, o: none, +<sub>p</sub>:potentially positive (see table 8.22)*  
*\*o: scores 0, -<sub>p</sub> or +<sub>p</sub>: score 0.25, - or +: score 0.5, -- or + +: score 1.*



- *Comparison of the indices' strength for the analysis of the fishing households food security*

The strength scores calculated in table 8.22 show that the LTDI, LTAI, STAI2 and the FCSI2 provide the same amount of information but on different non KMNP-related parameters. The FCSI and the STAI do not appear which means that they were not useful to the analysis of the non KMNP-related attributes of the fishing households'.

However, although not strong, the FCSI appears in table 8.23. The strength scores calculated in table 8.23 show that both long term indices (LTAI and LTDI), and particularly the LTAI provide more information on the KMNP-related attributes of the fishing households than the other indicators. The LTAI was also one of the stronger indicators in the analysis of the overall household sample (chapter 7). The FCSI confirms some of the information given by the LTDI on the fishing zones.

- *Causes of the variability*

The strongest positive influence detected in the parameters not directly related to the presence of the KMNP is the one of the ownership of boats on the LTAI. The fact that boat ownership indicated a higher LTAI was not surprising as buying a boat or necessary material to build a boat is taken into consideration in the calculation of the LTAI. However, no causality could be established and it is unlikely that owning a boat influences more food security than using a boat for example. Thus, although owning a boat indicates that at one time the households accumulated enough to invest in a boat, it does not separate the subsequent effects of owning a boat on the LTAI from the effects on of buying a boat on the score.

Shifts are part of both tables, they have been analysed as components of the households' fishing system, but they are also linked to the presence of the KMNP. The shifts result from the aid given by KWS to three fishing communities (including Kibuyuni and Mkwiro) in compensation for the loss of fishing grounds. The aid was given 14 years after the establishment of the KMNP in the form of 6 powered boats and nets. Thus, the effects of the shifts are considered to be linked to the KMNP.



However, although it was found that the households participating in shifts were likely to be better off in terms of LTDI than the others, no significant correlations was found between the percentage of participants at the fisher group level and the scores.

The best way of detecting the suspected direct effects of the KMNP on the surrounding fishery was thought to be the distance. First, the variation of the scores in relation to the distance of the villages from the KMNP and the Reserve was examined. The results showed that the only score to be significantly affected is the long term accumulation index. However, the LTAI was found also to vary with boat ownership. In order to verify whether the impact of distances on the fishing households owning at least one boat was significant, an ANOVA was used. It showed that when taking account of ownership, the LTAI did not vary significantly according to the distances from the Reserve and the KMNP. This suggested that no conclusions could be drawn on the direct impact of the KMNP on the long term accumulation index. Other factors could have influenced it strongly.

However, the results of a previous study (Watson, 1996) suggested that the lack of fish migration from the KMNP to the Reserve could be due to the fact that the reef is patchy and that coral heads are separated by large sandy areas which could act as a deterrent for the fish to migrate. It was thus thought that a better way of looking at the effects of the KMNP on the surrounding fishery would be to take into consideration the villages' fishing zones and their proximity to protected reefs. The villages were ranked according to the average distance of their main fishing zones in the SE monsoon (i.e. first round) from the KMNP borders and from the protected reefs. The potential link between the scores and the fishing zones median rank were investigated.

They showed that, at the individual level, the FCSI, LTDI and LTAI varied significantly according to the fishing zones median ranks. When aggregated at the group level, no clear relationship could be established in the case of the LTAI which was suspected to be affected by other parameters (e.g. ownership of boats). In



contrast, a negative relationship between both the LTDI and the FCSI and the fishing zones median rank (figure 8.6) could be observed. Thus, the further away the village is from the protected reefs and KMNP boundaries, the less food secure the households in the short term (first round, FCSI) and in the long term (LTDI).

However, the influence of two main parameters (i.e. cultivation of fields and participation in shifts) suspected to contribute to the variability of the LTDI had to be investigated. This was done by separating the fishing households into sub-groups. Although the LTDI of all the sub-groups (excluding each parameter in turn) did not vary significantly according to the fishing zone at the individual level (partly because of the lack of data points), the groups representing the majority of the households did. This was true when eliminating the variability due to the cultivation of fields through the selection of non-cultivating households, the participation in shifts by selecting non-participant in shifts, and then eliminating the variability due to both parameters. For these sub-groups, representing the majority of fishing households (from 60% to over 80%), the LTDI varied significantly according to the distance from the protected reefs and the relationship, if detected, was negative.

The number of confounding variables tends to make it difficult to conclude confidently on the impact of the KMNP on the surrounding fishery. However, from the results of the analysis it can be suggested that some positive effects of the proximity of the fishing zones to the protected reefs were detected through the analysis of the food security scores.

Furthermore, the villages were ranked on the basis of an estimation of the distance of their main fishing zones from the nearest protected reef. In order to have a more precise account of the effects of the KMNP on the fishing and on the maximum distance at which the effects can be detected, an analysis of the precise fishing areas used by households or identified groups of households would be needed. However, the above results confirm the findings of previous studies in that the distance can be a limiting factor (see chapter 2), and are similar to the perception the fishers have of the benefits of the KMNP (see chapter 5).



The main effects of the KMNP in terms of fishing are probably mostly felt by fishers fishing very near a protected reef, such as Kibuyuni's fishers. These results show, from a socio-economic angle, that the distance from the boundaries but more importantly, from the more productive areas of an MPA are limiting factors to the spill over effects. This suggests that MPAs are not homogenous and that this heterogeneity affects their likely effects on the surrounding fishery.

The fact that the effects of an MPA on the surrounding fishery can be restricted more by the distance from the productive areas within the protected ecosystem than by the distance from the MPAs boundaries should be taken into consideration when MPAs are established. Finally, these results indicate that some effects of the KMNP on the fishery could be detected by a food security analysis of the surrounding communities.



## 9 Tourism and the KMNP

International travellers spend USD445 million a year with an annual growth rate of 6.7% and, in 1997, tourism represented as much as 34% of the world's global service exports (UNESCO, 1999). Much of this growth is directed towards coastal areas, as since the 1950s coral reef associated environments, white sandy beaches, hot and exotic places have become more and more attractive to tourists (Price *et al.*, 1998). This has led to the increase of national economies' dependency on this trade. For example, in the Caribbean, tourism contributes on average 64% of the GDP of the small island States (Albuquerque and McElroy, 1992). In Kenya, where the coast has become the main destination, tourism is one of the most important sources of foreign exchange (GK, 1997).

Coral reef related tourism is a source of foreign exchange for host countries, it creates employment and increases the outlet for the local products (Beeckhuis, 1981, Spurgeon, 1992, Nolan, 1998). However, tourism also has costs. For example, anchoring, diving, trampling, litter, waste, construction related sedimentation, pollution and coastal development are associated with tourism development and are major causes of coral reef damage (IUCN, 1993). Furthermore, tourism has repercussions on local cultures which can lead to the re-definition of local values and social organisation (Robinson, 1999).

Up to now, MPAs have been created for tourism and environmental conservation. Tourism is considered to be one of their main benefits to the surrounding communities in the short term. This has been verified in the study area where the main benefits of the KMNP perceived by the park authorities and by the park's surrounding communities are linked to tourism income and employment. It was confirmed by the fact that households depending on park-related tourism were more food secure than the others in the short term (chapter 8).



However, up until recently (see chapter 5), the loss of fishing grounds due to the establishment of the KMNP had been perceived as the main effect of the KMNP by the communities. This had led to strong resentment.

In this chapter, the benefits of tourism suggested by the findings are investigated further. The effects of park related tourism are examined at the household, local and national levels. The inevitable development of tourism around the KMNP, tourism reliability and sustainability are questioned.

## **9.1 EFFECTS OF TOURISM IN THE STUDY SITES**

It was established in previous chapters that households depending on tourism related to the park (TMNP households) were more food secure than others. Park-related tourism emerged as an advantage of the MNP in the view of the surrounding communities. Thus KMNP-related tourism appeared as an important factor for understanding the communities' situations.

### **9.1.1 Aspects of tourism in the study area**

Nine medium and large tourism related businesses and numerous small operations function in the case study area. Most of them are linked to the presence of the Kisite Marine National Park. However, only five offer accommodation (three of which are KMNP-related). The characteristics of tourism in the case study area are described in the following section.



**9.1.1.1 The tour operators**

Several tour operators expressed the wish not to be named. For this reason, operations have been coded according to their link or not to the KMNP (respectively TMNP or T) and whether they are local owned (L) or not. Most of the operators linked to the KMNP take tourists snorkelling or diving on motorised old fashioned wooden sailing boats (“dhows”). Small private boat operators use mainly large canoes fitted with engines. Other tourism businesses include sports fishing and diving operations.

Operations were considered as local if their owner was from the local communities. The distinction between local and not local could be ambiguous as some owners have lived in Shimoni for more than 30 years and are Kenyan nationals. However, for the purpose of this research, “local” refers to the people born and bred in the Shimoni area. Non locals are mainly Kenyans from upcountry and Kenyans of European or Asian origins.

**Table 9.1: Some characteristics of the tour operators in the study site**

Code	Description/types	Size
TMNP1	Lunch/snorkelling /Diving	large
TMNP2	Lunch/snorkelling	Medium
TMNP3	Lunch/ Dolphin viewing	Medium
TMNP4	Hotel/snorkelling	Medium
TMNPL1	Hotel/lunch/snorkelling	Large
TMNPL2	Snorkelling	Small
TMNPL3	Snorkelling	Medium
T1	Sports fishing	Medium
T2	Sports fishing	Small
T3	Diving cruises	Small

The sizes small, medium and large were determined as follows; small operations which are mostly composed of local private boat operators who take one to 5 tourists to the KMNP at a time. Medium operations cater for up to 40 people at a time. A large operation can cater for more than 40-50 people at a time.

The two small and medium scale sport fishing operations (T1 and T2) are based in Shimoni but operate offshore (e.g. Pemba channel), along with the diving operation



which takes tourists to the island of Pemba, in Tanzania. Although the owners appreciate the presence of the KMNP, their presence is not linked to the KMNP. In addition, several operators which are not based in the study area use the KMNP which they access by boat. Although the tourists they bring pay fees to the KMNP authorities, these operators have no links with the communities surrounding the KMNP.

Three main dhow operators run trips to the KMNP. One markets dolphin viewing and was taking up to 15 people a day in the peak season but is extending (TMNP3). A medium scale operation based on the Wasini island takes small groups of tourists to snorkel in the KMNP (TMNP2). A larger scale operation takes up to 100 tourists/day (TMNP1). All the above non local operations provide traditional lunches but offer no accommodation.

A locally owned hotel based on the island can accommodate 20 people and has a sea food restaurant sitting up to a 100 people (TMNPL1). The owner has dhows to take people snorkelling in the KMNP. KWS, the park authority, also uses the services provided by this local operator but KWS has its own dhows and can accommodate people in its relatively small camp on the mainland. Finally, a main land based hotel which has up to 200 people a year, takes people in the KMNP to snorkel and dive (TMNP4). These operations depend on the presence of the KMNP. To these, can be added a number of privately owned boats operating on a daily basis taking tourists to the KMNP (TMNPL2). Small boat operators can be part of the Shimoni Private Boat Operators' Association which also uses two motor dhows given by KWS/USAID to Shimoni in 1995. However, at the time of the fieldwork, the boats were not operating as they needed repairs.

Thus three MNP related operations offer accommodation; two on the mainland, one on the island. However, most of the visitors to the KMNP are day trippers.



9.1.1.2 Importance of KMNP- related tourism the area

The main activity in the study site is artisanal fishing. However, in Wasini and Mkwiro tourism has become an important source of employment, particularly KMNP- related tourism (TMNP) as shown in figure 9.1.

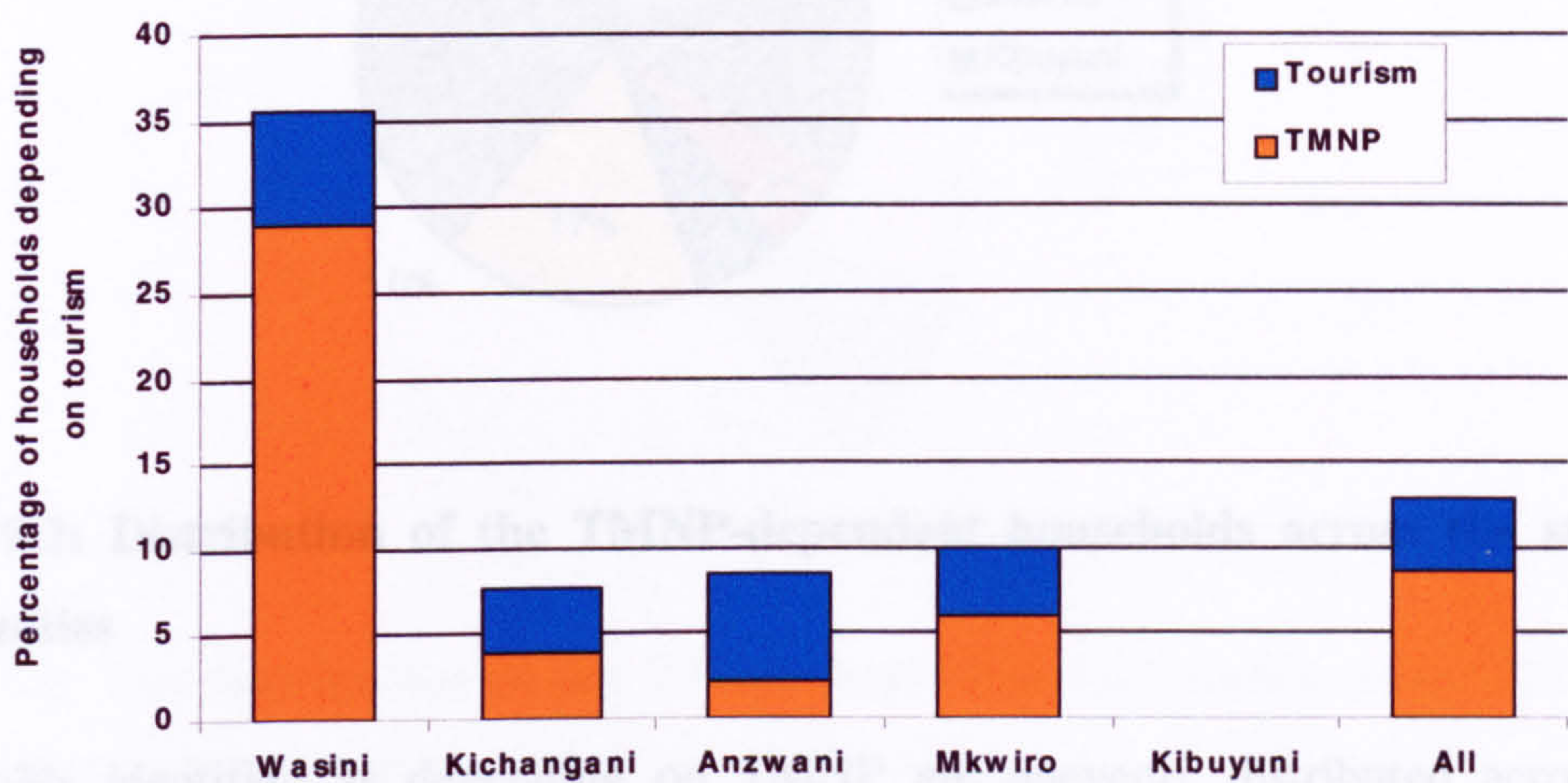


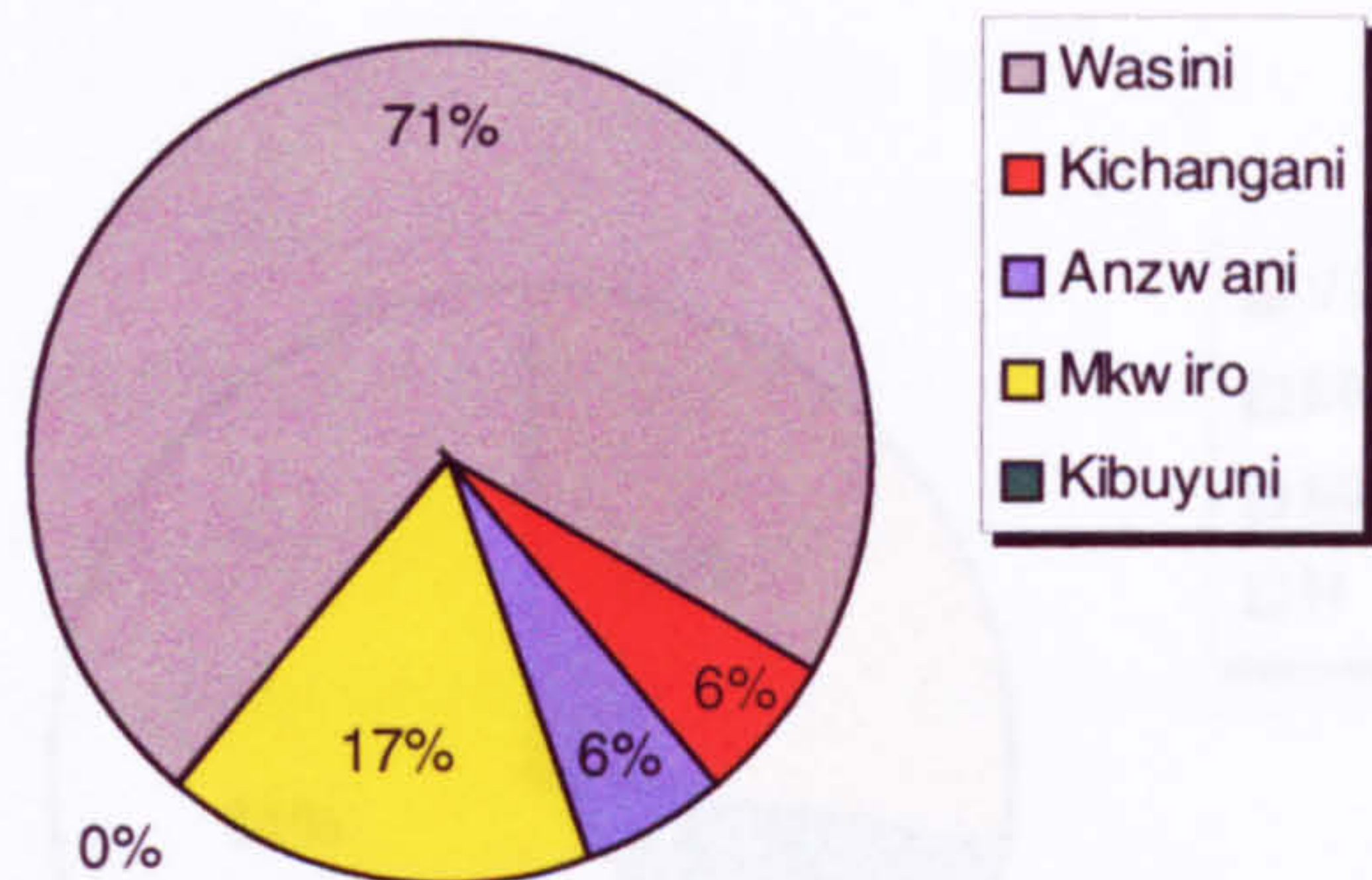
Figure 9.1: Households’ dependence on tourism activities at the community level<sup>17</sup>

Wasini is by far the most tourism-orientated village with 35.6% of the sampled families depending mainly on this activity. More than three quarters of these depend on KMNP-related tourism (TMNP). Anzwani, the control community, follows Wasini and Mkwiro in terms the importance of tourism in the community (8.5%), however only 2.1% of these depend on TMNP. In Kichangani, the nearest village on the mainland to main employers, 7.6% of the households are tourism dependent about half of which is linked to the park. None of Kibuyuni’s households depend mainly on tourism. This is suspected to be due to the distance of Kibuyuni to the main tour operators (see chapter 7).

<sup>17</sup> The percentages are based on the more stringent division of the population into categories of activities (excluding the “mixed” category, see chapter 8).



Thus, the tourism developed around the presence of the KMNP affects mainly the communities of Wasini and Mkwiro. KMNP tourism related employment mildly affects the other surrounding communities as shown in figure 9.2.



**Figure 9.2: Distribution of the TMNP-dependent households across the studied communities**

Households identified as depending on TMNP are unevenly distributed across the communities. 89% of them were located on Wasini island (72.2% in Wasini and 16.7% in Mkwiro). Only 18 households are mainly depending on TMNP out of the 210 sampled households.

**9.1.2 KMNP-related tourism and household food security**

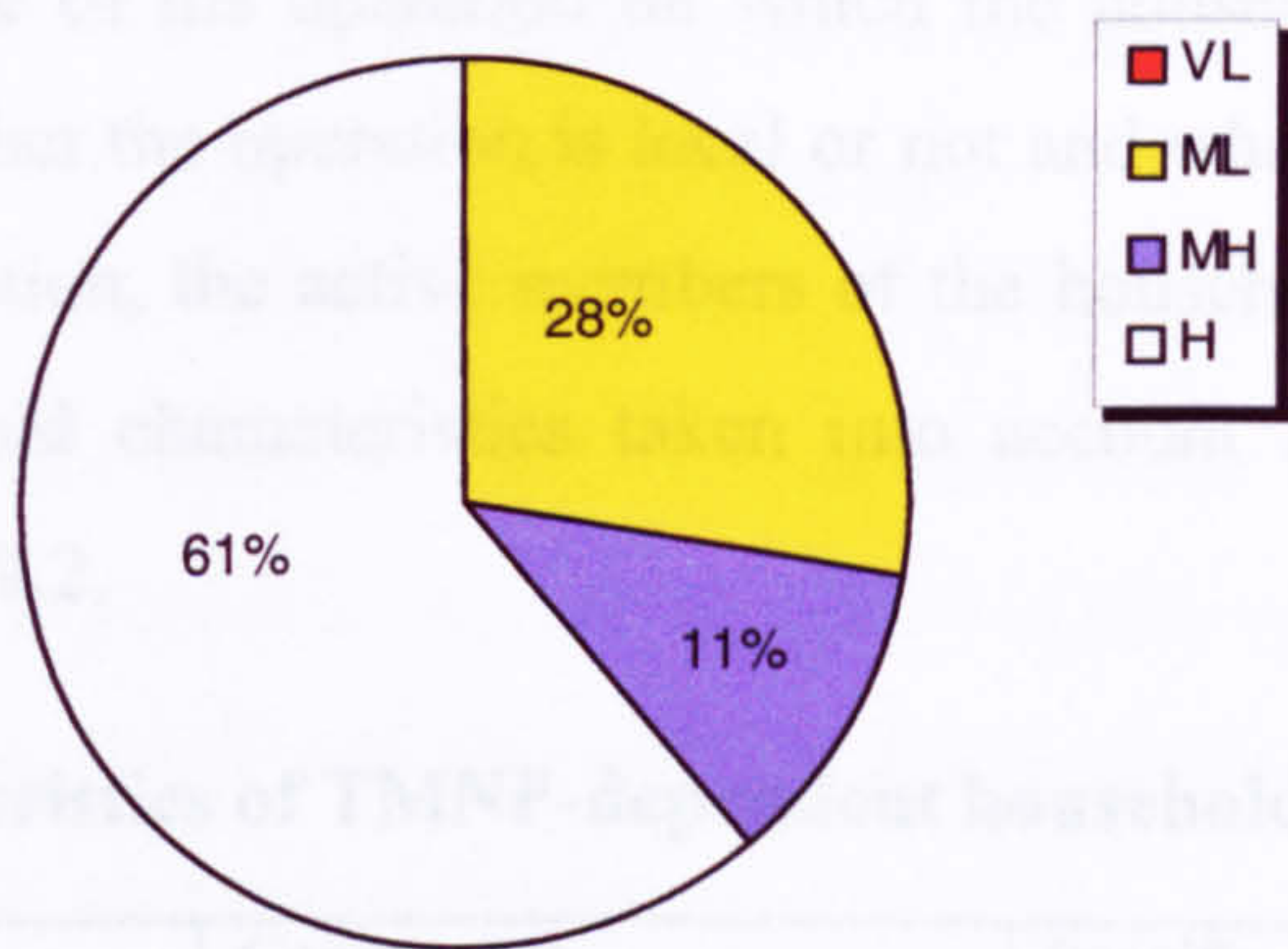
The effects of different aspects of KMNP-related tourism on the situation of TMNP-dependent households are investigated in the section below. The households mainly dependent on TMNP represent only 18 households out of 210 surveyed households (8.5%). The small sample restricted the possibilities of analysis, however the variability among these households and the potential factors causing this variability were studied.

**9.1.2.1 Variability in the households' scores**

A strong negative correlation was found between the distance of the communities from the main tour operators and the percentage of households depending on park-related tourism (see chapter 7). Moreover, it was found that the households depending on



tourism related to the KMNP were better off in the short term than other households. The figure 9.3 illustrates this latter point by showing the distribution of the TMNP-dependent households across the short term food security groups (as defined in section 7.1.2).



**Figure 9.3: The distribution of the TMNP-dependent households across the short term food security groups**

No TMNP-dependent households are part of the very low food security group and two thirds of them were part of the higher food security group. However, more than a quarter belonged to the lower half of the food security groups (ML). The distribution of the cases across the food security groups suggests that the TMNP group is not homogenous and that the situation of TMNP households varies.

In order to investigate the variability across the groups, parametric and non-parametric tests were used. ANOVA and Kruskal-Wallis tests were carried out to determine whether the scores varied significantly according to the short term food security groups (fig.9.3). Results showed that the food coping strategies and long term divestment indices varied significantly across the groups (for FCSI and LTDI,  $p<0.05$ ). The potential explanations for this variability were investigated.



9.1.2.2 Explaining the variability

The factors expected to affect the scores were geographic parameters (community, distances from the KMNP and from the main tour operators), demographic parameters (number of dependants, household size, age). The other considered parameters were the size of the operation on which the household depends (large, medium or small), whether the operation is local or not and whether, if working in a small private boat operation, the active members of the households were owners or employed. The household characteristics taken into account for the analysis are summarised in the table 9.2.

Table 9.2 The characteristics of TMNP-dependent households

Case	Demographic			Geographic			Specific		
	Ndep	Household size	age	Community	Distances		Operation / origin	size	If boat op. owning
					Km	Minutes			
1	3	3	M	Wasini	0.5	5	TMNP2	M	-
2	36	6	O	Wasini	id.*	id.	L2	S	Yes
3	26	6	M	Wasini	id.	id.	TMNP1	L	-
4	37	7	O	Wasini	id.	id.	L2	S	No
5	3.3	10	M	Wasini	id.	id.	L2	S	No
6	2	2	Y	Wasini	id.	id.	TMNP1	L	-
7	6	6	M	Wasini	id.	id.	L2	S	Yes
8	4.67	7	Y	Wasini	id.	id.	L2	S	No
9	10	10	O	Wasini	id.	id.	L1	L	No
10	7	7	M	Wasini	id.	id.	L1	L	No
11	8	8	Y	Wasini	id.	id.	L2	S	Yes
12	4	4	Y	Wasini	id.	id.	L1	L	No
13	4	4	Y	Wasini	id.	Id.	TMNP1	L	-
14	2.85	10	Y	Kichangani	3	25	TMNP3	M	-
15	4	4	M	Anzwani	4.5	40	TMNP4	M	-
16	3	3	Y	Mkwiro	4.5	45	TMNP1	L	-
17	3	3	Y	Mkwiro	id.	id.	L2	S	No
18	5.3	8	Y	Mkwiro	id.	id.	TMNP1	L	

Ndep: number of dependants per source of income, Age: young (Y), middle (M), old (O); Size: small (s), medium (M), large (L).

\*: *idem*.

To analyse the potential link between the above parameters and the food security scores of the TMNP-dependent households, ANOVAs, two sample t-tests, Pearson’s correlation coefficients and Spearman sign-rank correlation coefficients were used. Due to the low number of cases in the TMNP group, it was not possible to divide



them into sub-groups as was done in the case of the fishers' households (see chapter 8).

When the geographic parameters were investigated, ANOVA and a Kruskal-Wallis tests showed that no scores varied according to the communities ( $p>0.05$ ) except for the LTAI ( $p<0.05$ ). It was also found, using the Pearson's correlation coefficient, that the distance from the main employers in kilometres and in minutes only affected significantly negatively<sup>19</sup> the long term divestment index.

Using an ANOVA, it was possible to determine that none of the demographic parameters (number of dependants, household size and the age of the household member taking part in the TMNP activity) affected significantly the households' food security scores whether in the long or short term.

Finally, the characteristics of the operations specific to the TMNP activities were tested using two sample t-tests and an ANOVA. No significant differences were found between the food security scores according to the origin of the employer, the size of the operation or the employer. Moreover, of the households depending on small boat operations no significant differences were found between the households employed and the ones owning their own boat.

None of the identified factors had a strong effect on the scores of the TMNP-dependent households except the distance from the main tour operators. This was found on the overall surveyed population as well. These results could be due to the small sample size and to the fact most of the TMNP households are from Wasini. It is suspected that the small sample and the skewed distribution does not allow an in-depth analysis of the variability between the households. Furthermore, the small sample size introduces doubts on the reality of the few relationships found between the scores and some of the factors.

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<sup>19</sup> The critical coefficient for  $n=18$  is  $|r_{critic}| = |0.467|$ .



A purposive sampling of the TMNP-dependent households in each studied community might have been more appropriate in this case in order to study further the differences between the households, rather than the random sampling chosen for the household surveys on which the analysis is based. Thus, further investigation is needed to draw any conclusions on the variability of the situation of TMNP households and the factors behind it.

### **9.1.3 The effects of the KMNP at the local level**

The gross income from tourism in the area is more than 137 Million Ksh per year (Emerton, 1999) for KWS and the operators in the area. The two main ways in which this income is distributed to the communities are employment (and direct income for the self-employed) and aid. These were the starting point of the investigation concerning the benefits of the MNP through tourism at the community level.

The results of the following section are based on semi-structured interviews with the Kisite park warden and on questionnaires distributed to the tour operators. Although informal or semi-structured interviews were favoured in this research, tour operators preferred to answer written questions. However, the questions were open ended and when necessary, some points were discussed with the informants.

#### **9.1.3.1 Income/employment**

The three main objectives of the tour operators' questionnaire (appendix 9) were to get background information on the operators, understand how much the operators contribute directly to the area through employment or other means, and finally to investigate their perception of the changes in the area and in the KMNP since their establishment.



The questionnaires were only distributed to the four non local KMNP-related tour operators. From their answers and further discussions it was possible to estimate the number of people employed by them to be between 120 and 148 according to the season. To these can be added about 15 people employed by the park authorities and 20 to 30 people involved at least part-time in KMNP-related tourism activities (local boat operators). Except for KWS, the tour operators in the study area employ mostly local people, unlike in Diani (Malleret-King, 1996, Rubens, 1996).

The total salaries from the non-local operators were estimated at between 9.6 and 12 million Ksh in 1997 from the questionnaires. However, some of the tour operators were reluctant to reveal the salaries they paid so this estimation was made on the basis of known individual salaries (between 6000 and 7886 Ksh). The gross income received by the local boat operators was estimated by Emerton (1999) at 10.92 million Ksh per year.

KMNP-related tourism represents 76.5% of the total of tourism employment in the area and the largest tour operator is essential to this contribution. In 1996, the operator TMNP1 contributed for 63.5% of the total number of KMNP visitors for the year (25 500 out of the total of 40162 visitors) (TMNP1 questionnaire, KWS report, 1996).

In addition to employment and income, the communities benefit indirectly through the sale of food products (Emerton, 1999) and particularly of fish. The local operator buys “chapatis” and other prepared foods from women whom are not employed on a permanent basis. Most of the food products are bought in the Mombasa market by the main operators. However, some fishers are the ones to benefit most from the tourism market as seafood is always bought locally. This increased demand can put pressure on some targeted resources to the point of depletion (e.g. mangrove crabs).



### **9.1.3.2 Direct and indirect benefits of tourism through aid**

Aid is considered as one of the main benefits of the KMNP by the communities along with the tourism related employment (see chapter 5). The aid projects referred to by the communities are mainly the aid provided by KWS through the Wildlife for Development Fund which gave six boats to Shimoni, Kibuyuni and Mkwiro (see chapter 5). This indirect benefit was given in compensation for the loss of fishing grounds 17 years after the establishment of the KMNP.

The Fund was created when KWS focus changed from forceful top-down enforcement, and shifted to communities and partnership (see chapter 5). In order to reduce the conflicts between KWS and the local communities in the area, KWS got involved in several projects from 1993 through the Wildlife for Development Fund (Emerton, 1999). These projects included the building of classrooms, donating desks to schools, building a nursery, repairing a fish depot and the gifts of six boats and gear to the fishers of Kibuyuni, Shimoni and Mkwiro (warden, pers. comm., fishers, pers. comm.). However, the fund was not active during the fieldwork and its activities had totally stopped in 1998 (Emerton, 1999).

In addition to the aid given by KWS, the questionnaires showed that tour operators also contribute directly to the communities. For example, they help the dispensary by giving medicine, they sponsor educational trips for school children and help to fund schools. Moreover, the main tour operator pays a levy of 5 Ksh per tourist which is collected by a community development fund in Wasini. The levy is part of the agreement under which the operator purchased the plot on Wasini Island (Emerton, 1999). However, during the fieldwork the administration of these funds were a source of tension as confirmed by Emerton (1999). Furthermore, a 10 Ksh per visitor landed on Wasini is also supposed to be paid to the community fund but there is little evidence of the payment being made (Emerton, 1999).

The benefits from KMNP-related tourism for the surrounding communities appear mainly in the form of employment and income. Non-local private operators and KWS also contribute through aid as discussed above, but it is still a very small



proportion of the revenues of tourism (Emerton, 1999). Furthermore, the income and benefits from KMNP-related tourism are not only distributed at the local level but also at the national level.

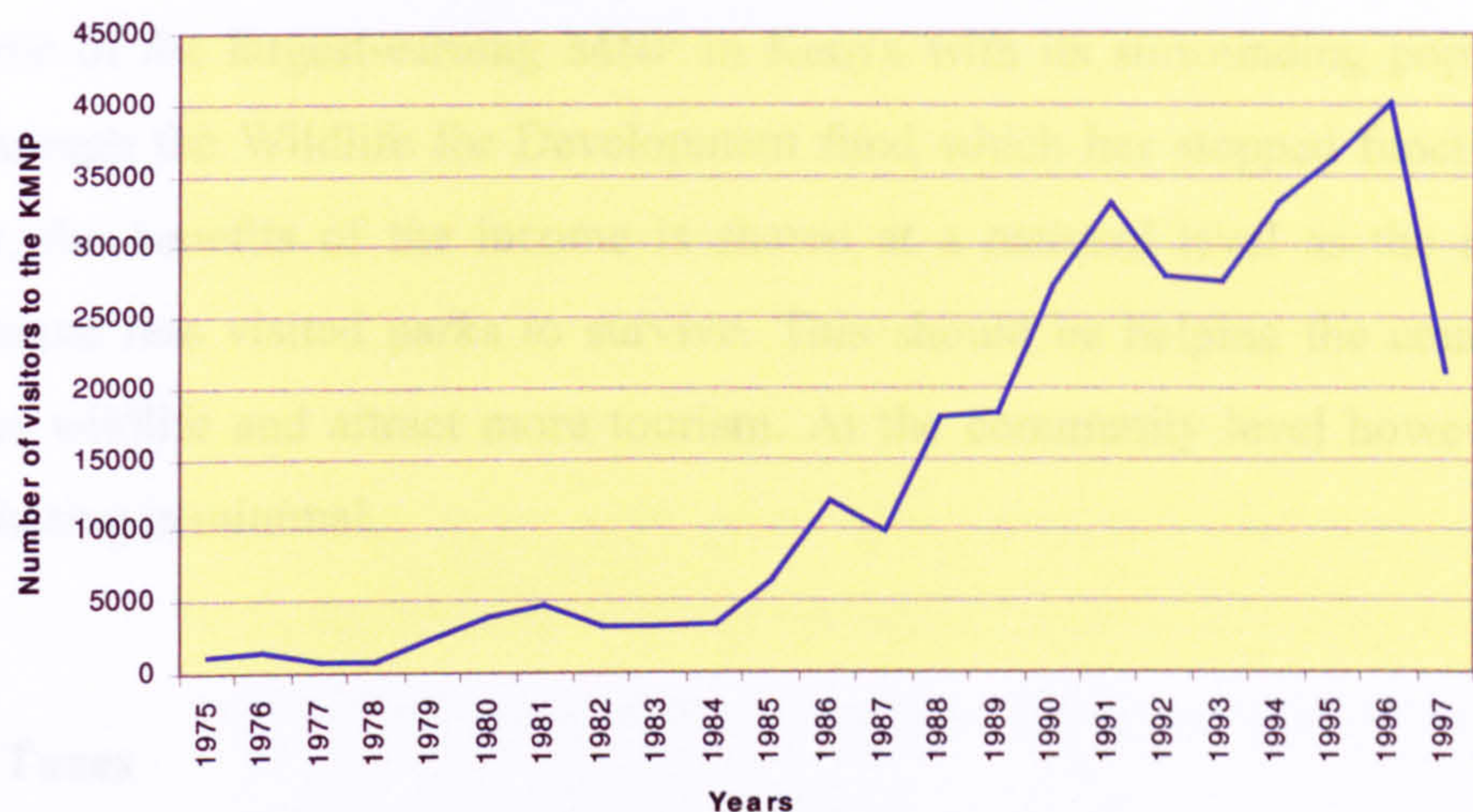
#### **9.1.4 Benefits of KMNP-related tourism at other levels**

The 137 million Ksh gross income from tourism in the KMNP include the revenue collected by KWS through park fees. These have not been discussed in the section above as most of the revenue collected by KWS is not re-injected at the local level. Similarly, part of the total income derived from KMNP-related tourism is taken out of the local level through taxes.

##### **9.1.4.1 Number of visitors and KMNP income**

The park income has not been mentioned at the community level as, although the Kisumu MNP has a local administrative base in Shimoni, the revenues are not kept locally. The KMNP is the marine park generating the most income in the country (warden, pers. comm.). The number of visitors multiplied more than 33 times between 1975 and 1996 (from 1,209 tourists in 1975 to 40,162 in 1996; KWS yearly reports). However, between 1996 and 1997, the number of visitors halved because of political and natural events which occurred at the end of 1997 (see chapter 6).





**Figure 9.4: Evolution of the numbers of visitors to the KMNP since 1975** (source: KWS Shimoni yearly reports)

Entry fees were introduced in November 1975 (Emerton, 1999) and are now USD5 for a non-resident adult, USD2 for a non-resident foreign child. A resident adult pays 150 Ksh and boats pay 200 Ksh. Most visitors don't pay their fees directly as these are included in the price of their day trip. The tour operators then pay KWS Shimoni monthly (including the tourist, staff and boat fees). The income raised by the KMNP has increased from a few 10 000s Ksh per year in the 1970s to 15 millions Ksh in 1996, dropping to 8.9 millions in 1997 (not corrected for inflation).

These revenues are not kept at the local level. They are centralised in Nairobi at the KWS headquarters which then redistributes them to the parks and reserves of the country through their budget. The budget allowed to the KMNP in 1997 averaged 200 000 to 300 000 Ksh per month. According to Emerton (1999) the entry fees and the income generated by the KWS camp Eden are 8 times higher than its expenditures. However, the budget allocated to the KWS Shimoni has dropped steadily since the creation of the KMNP from more than 45 million Ksh in 1978 to about 3 million Ksh in 1997 (Emerton, 1999). The reduction in the budget has created a situation where the lack of financing hinders the good functioning of the park management (tour operator, pers. comm., warden, pers. comm., Emerton, 1999).



Because of the way the revenues are managed in KWS, there is very little sharing of the income of the largest-earning MNP in Kenya with its surrounding population except through the Wildlife for Development fund which has stopped functioning. However, the benefits of the income is shared at a national level as the income enables some less visited parks to survive. This should be helping the country to protect its wildlife and attract more tourism. At the community level however the benefit-sharing is minimal.

#### **9.1.4.2 Taxes**

Tourism businesses have to pay taxes which are centralised and then re-allocated at more decentralised levels. These should contribute to the improvement of infrastructure, health and education around the country. Benefits from taxes are not felt strongly at the local level. For example, the maintenance of the Shimoni road is very sporadic. Communities surrounding the park have no access to electricity and some of the communities are not linked to any road or even by a dirt road to major road axes. The schools are financed predominantly by private operators as was the dispensary<sup>20</sup>.

Similarly to the KWS revenue collection, taxes are centralised and the sharing at the local level is minimal.

#### **9.1.4.3 Conclusions**

The KMNP-related tourism is estimated to bring a gross income of 137.02 million Ksh and a net benefit of 124.76 million Ksh (calculated from Emerton, 1999) . 90% of the costs of KMNP-related tourism are borne by the surrounding communities whose opportunity costs have been estimated at 11.02 million Ksh per year (Emerton, 1999). The rest is paid at the national level by KWS in the form of running costs estimated at approximately 1.23 million Ksh per year (Emerton, 1999).



Although private operators depend on the existence of the KMNP for their business they do not participate actively in the management of the KMNP. The distribution of economic benefits from tourism to the surrounding communities is not proportional to the costs borne by them, even though the income and the salaries received appear to compensate the opportunity costs. Furthermore, communities feel that non-local private tour operators try to reduce their share in the tourism industry by discouraging tourists from going with local boat operators. This increases the disproportion between the benefits of KMNP-related benefits received by non-local private operators (90% of the gross income; Emerton, 1999) and local private boat operators.

A distortion of the distribution of benefits and costs appears also amongst the surrounding communities. For example, the opportunity cost of the KMNP is borne by five communities who used to fish in the now forbidden grounds, mainly Shimoni, Wasini, Kichangani, Mkwiro and Kibuyuni. However, employment opportunities and income mainly benefit only three out of these five communities Wasini, Mkwiro and Shimoni. Furthermore, the direct contribution of tour operators through the payment of a levy per tourists is to the benefit of only one the communities; Wasini.

According to Emerton's study (1999) the distribution of benefits is skewed towards the non-local private operators and the costs are skewed towards the communities. This meets the communities' point of view, which had led some of them to resent the KMNP strongly. Changes in the financing of the MNP could increase the benefits to the surrounding communities (see Emerton, 1999).

<sup>20</sup> Because of the disappearance of medicine private help to the dispensary has decreased (tour operators, pers. comm.).



## **9.2 RELIABILITY OF TOURISM**

In the previous section, it was suggested that the net benefits of KMNP-related tourism are positive but that the distribution of the benefits create a situation where the communities are not the main winners. Tourism appears as an important activity in the area, in some villages more and more households depend on it. Thus, the questions of reliability and sustainability of KMNP-related tourism have to be raised. Observations, literature, questionnaires and interviews are the base for the analysis and discussion below.

### **9.2.1 Unpredictability**

Most MPAs have been developed for tourism and environmental conservation. A major objective of No Take Zones (NTZ) in coral reef areas is to conserve fishing resources (see chapter 2). The recovery of fish stocks is also a strong attraction to tourists, and this is often a primary reason for their establishment. Although MPAs are associated with tourism, the question of whether tourism is a natural development from the creation of these zones and what is involved in the establishment of a tourism industry has to be discussed. Although tourism is a corollary of the KMNP according to the communities and one of its main benefits in terms of employment, can it be assumed that tourism will develop and benefit surrounding communities? The case of the KMNP throws light on several aspects of these questions.

#### **9.2.1.1 The role of the KMNP in the presence of tourism**

The link between the KMNP and tourism was studied at two levels in the context of the study area. On the one hand, the role the KMNP played in the establishment of the main tour operators was examined. On the other hand the role the KMNP played in the choice of tourists to come to the area was investigated.



Although interest for the coral reef in Kisite was always high (fishers, pers. comm.) and some local boat operators might have been established before the presence of the park, most of the small local operations are a direct consequence of the presence of the KMNP. However, I wanted to know whether the main operators were present because of the KMNP. Thus, questions about how long the main non-local tour operators had been in the area (see table 9.3) and the reasons for their establishment in this area were asked.

**Table 9.3: Number of years since the establishment of the non-local tour operators**

Operators	Before MNP	>10 years	<10 years
TMNP1	X	X	
TMNP2			X
TMNP3			X
TMNP4		X	
T1			X
T2			
T3			X

Only one of the non-local tour operators (sport fishing operation) was established before the KMNP was gazetted. Two of the park-related operations were established more than 10 years before the fieldwork but most of the operators were established in the last 10 years. None of the owners of park-related tour operations stated that the KMNP had been the main reason for their establishment in the area. However, the quality of the marine environment, the marine life and the remoteness of the place were reasons mentioned by all of the informants. The quality of the marine environment and the marine life could be considered as one of the benefits of the presence of the KMNP. Although the operators might have established without the park, it is likely that the KMNP was at least partly responsible for the presence of the non-local tour operators in the area.

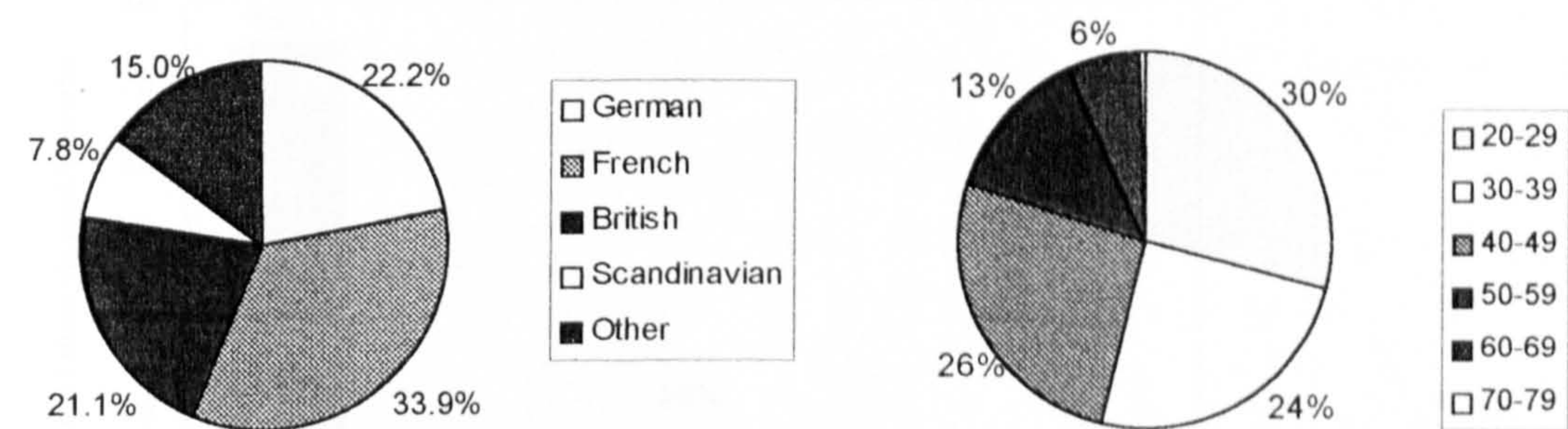
### 9.2.1.2 The role of the KMNP in attracting tourists

Similarly, to examine whether the KMNP is the main reason for the tourists to come to the area, 182 questionnaires were distributed to guests of the largest KMNP-related non-local operation (TMNP1). The questionnaires were distributed in English



and French from May 1997 to January 1998<sup>20</sup>. The objective was to know why the informants chose to come to the area and whether the KMNP had played a key role in this choice. The questions were open-ended and the informants were asked to list the reasons for which they had decided to come on the day trip. Their nationality, age group (adults), the reason for them coming to Kenya and their favourite moment in the tour were also investigated (appendix 11). One questionnaire per family for willing families was distributed at the end of the day trip.

The results show that a wide variety of nationalities were represented in the day trip but British, French and German nationals dominated (77.2%, see figure 9.5). Similarly, all age groups were represented as shown in figure 9.6.



**Figure 9.5 : Nationalities of the tourists      Figure 9.6 :Age groups of the tourists**

The “other” category of nationalities (15% of the sampled tourists) includes Southern Europeans, Southern Africans and Eastern Europeans (mainly Russians). All age groups came but tourists between 20s and 50s dominated the sample (80%; figure 9.6).

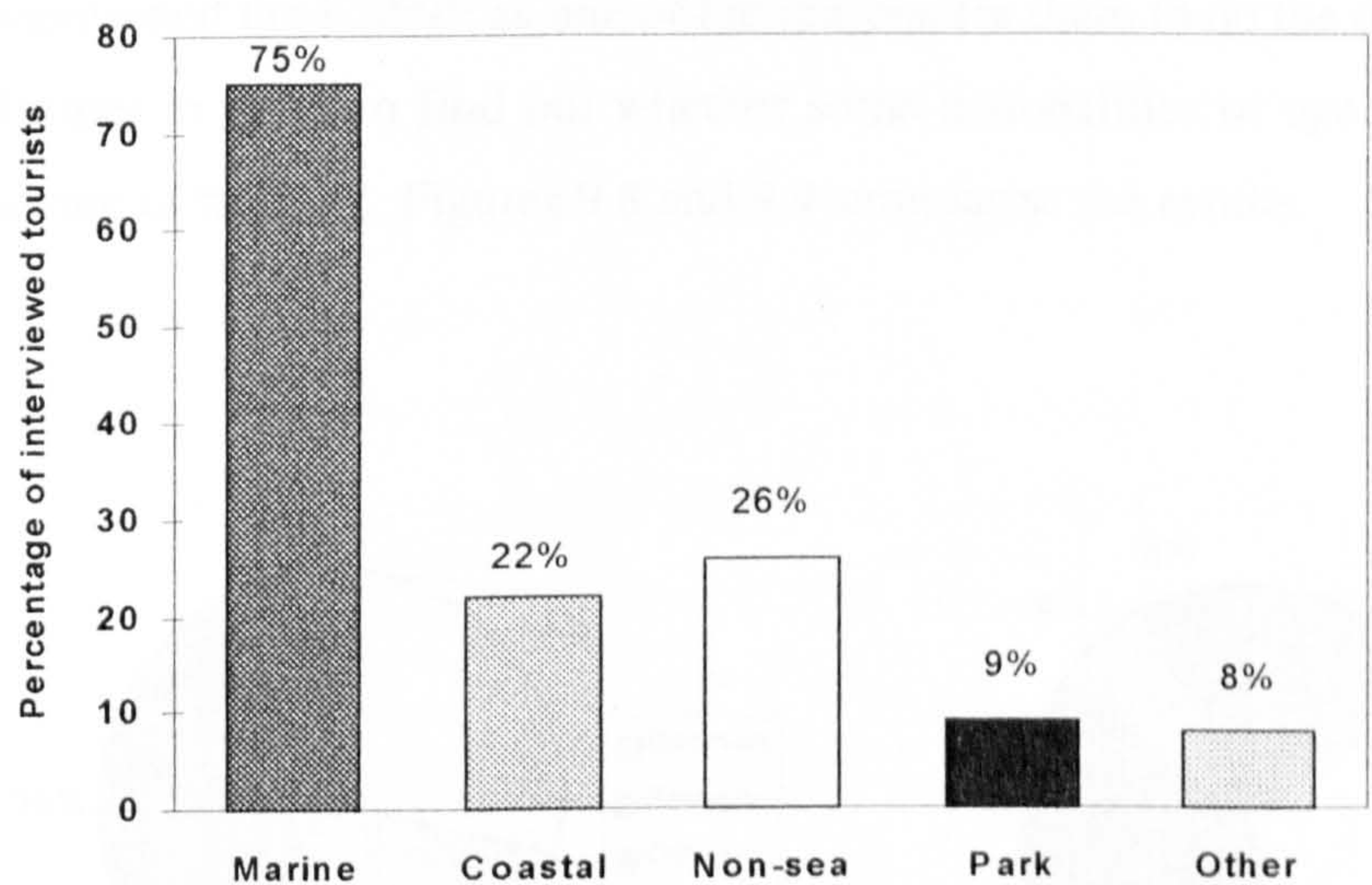
All the informants interviewed were day trippers based in Diani, Mombasa, Nyali or Msambweni. The tour operator collects them in the morning at their hotel. The bus

<sup>20</sup> The questionnaires were distributed on an irregular basis as I wanted to be there to discuss the answers if necessary. They were distributed so as to fit in with the household surveys which meant that I could only distribute them if going to the island.



trip to Shimoni lasted from 45 minutes to 1h 45 to 2 h depending on the departure area and the time of the year<sup>21</sup>.

The main interest of the questionnaires lay in the list of reasons for which the informants came to the study area. The answers were coded and analysed. The results were quite surprising. Fifteen categories of answers were identified and grouped into five categories. The five categories are marine related reasons (e.g. marine life, coral, fish, snorkelling..), coastal related reasons (e.g. sailing, beach..), non-marine related reasons (e.g. food, culture, another part of Kenya, the real Kenya), because of the KMNP (including nature reserve and related terms), and other reasons which included reasons such as “it was not far, it only took a day, it was not too expensive, someone had mentioned it”.



**Figure 9.7: Main reasons given by the tourists for coming to the day trip**

Informants listed on average two reasons, which they identified as playing a role in their decision to do the trip. Although marine-related reasons were mentioned on 75% of the questionnaires only 9% of the questionnaires mentioned the KMNP as such (see figure 9.7). The small percentage of informants mentioning the park as one of the main reason for them coming suggests that tourists might not be familiar with

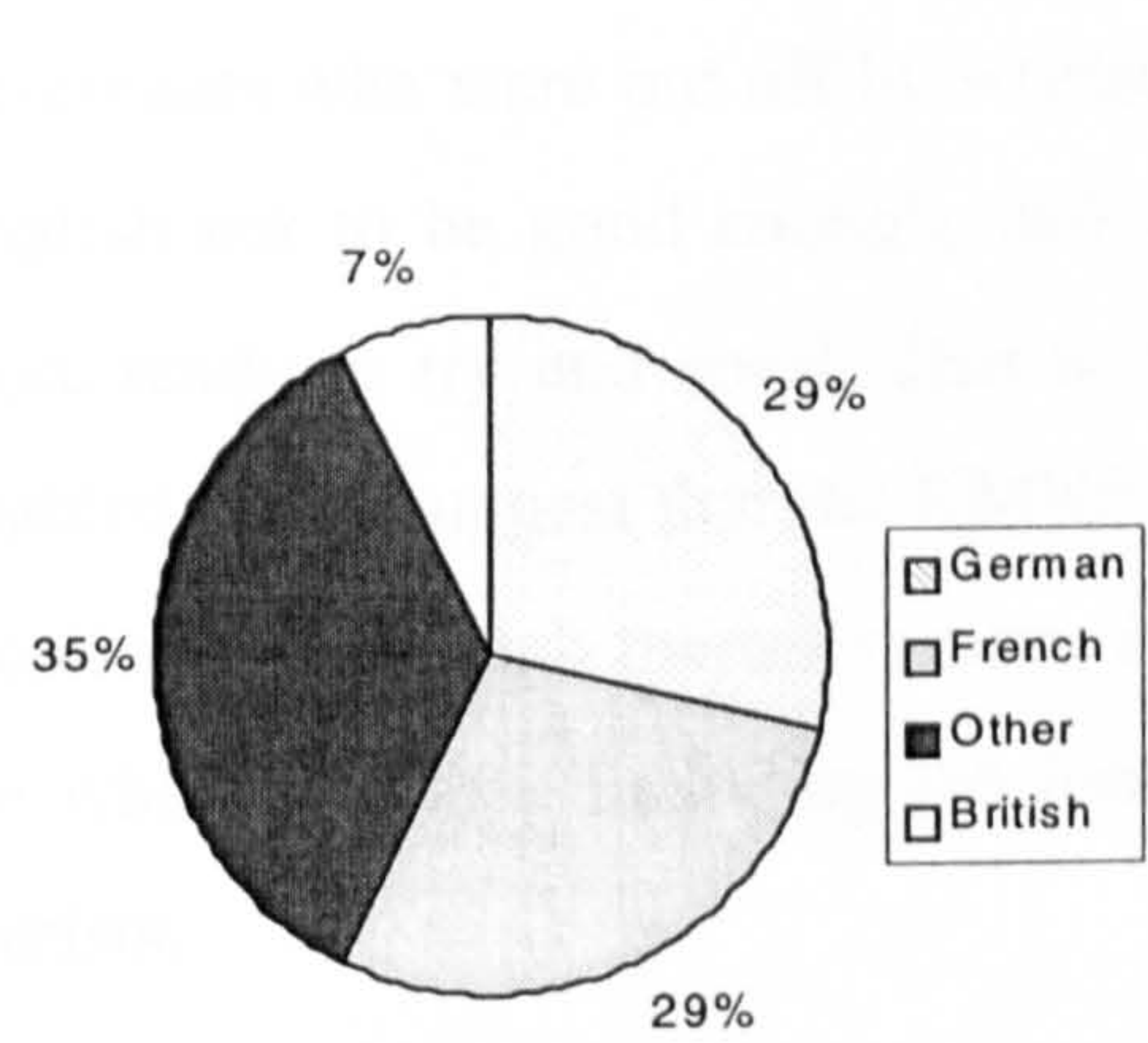
<sup>21</sup> The 15 km of dirt road linking Shimoni to the main road was very degraded from the middle of the fieldwork and impassable for two or three weeks after the torrential rains due to El Nino.



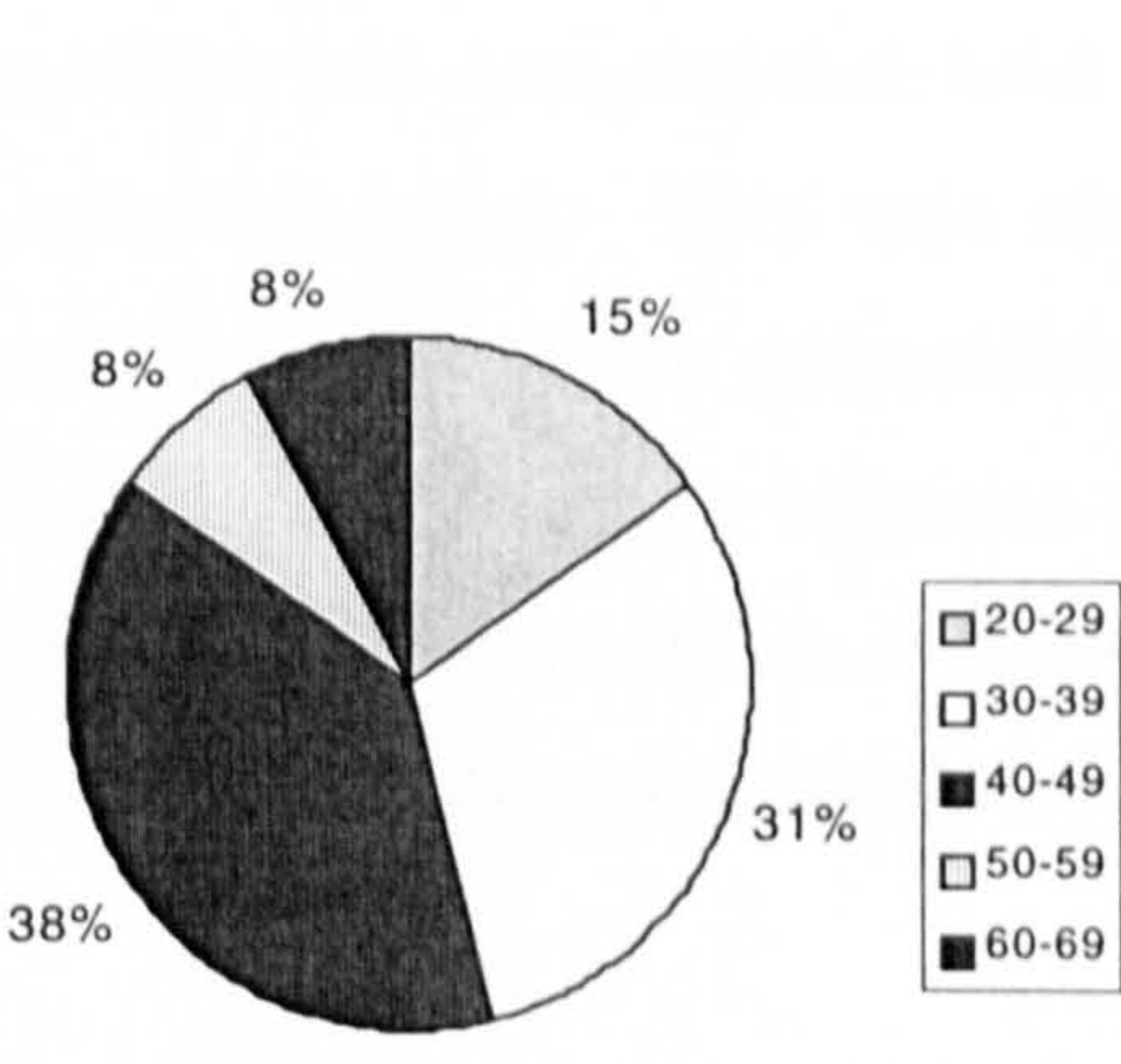
the concept of MNP or MPA and might not be aware of the difference between the marine life outside and inside a marine protected area.

It might appear that the presence of the KMNP has not really contributed towards the development of tourism on the Kisite reefs, since many tourists were unaware of the KMNP. Although this indicates the KMNP is missing the opportunity to publicise its resources, it does not necessarily follow that it has not enhanced tourism use. If the tour operators run tours to Kisite because they know the KMNP has good quality reefs, then the KMNP has promoted tourism, whether the people they take know of the KMNP or not.

The characteristics (nationality and age) of the 9% informants (16 informants) who mentioned the KMNP as one of the reasons for them to do the day trip were explored further in order to find out whether some nationalities or age group could be more aware of the park. Figures 9.8 and 9.9 summarise the results.



**Figure 9.8: Nationality of the 9 % tourists who mentioned the park as a reason for coming**



**Figure 9.9: Age groups of the 9% tourists who mentioned the park as a reason for coming**

The dominating age groups are similar to the ones of the overall sample. However, the distribution of the nationalities differ. Although French and German are still part of the dominating groups, the “other” nationals have taken over from the British, representing 35% (mainly Italians) of the sub-group. The difference in the country pattern of the sub-group could suggest that there is a difference in the way the tour is



advertised in the countries of origin or by the tour leaders in the hotels. It could also mean that some nationals are more familiar with the concept of protected areas.

Because of the lack of time, the analysis was succinct. The questionnaires could only be distributed for one of the tour operations thus probably introducing a bias in the sample. Moreover, the questionnaires were only translated in English and French which made it difficult for the Eastern Europeans and Germans to complete the questionnaires. Furthermore, it was not possible to pursue the investigation and research the different ways in which the tour was advertised in order to understand whether the differences in nationalities between the two groups could be explained by the advertising strategy.

However, the questionnaires were distributed in the tour operator catering for the largest number of visitors (63% of the park visitors in 1996). The answers were sometimes discussed orally with the non-English and non-French speakers which enabled some information to be gathered. This was possible because some of these informants who were put off by written questions when they estimated their level of English not to be good enough, had however some vocabulary. They were often more ready to try and speak than to write. Thus, the results of the questionnaires enabled me to suggest that the KMNP as such is not by itself the main attraction for the tourist. Although marine reasons are important in the tourists' choice, it is often the whole package, including the food and service such as transport which attract tourists.

Because there is no advertising of the KMNP as such and the access of the KMNP is very difficult (or was very difficult) due to the state of the road, the percentage of tourists coming by their own means is very small (pers. obs.). This reduces the business opportunities for local boat operators and the share of the benefits to the local communities. This is even more the case if the tourists are discouraged from going with local boat operators.



The case study area shows that for KMNP-related tourism to benefit surrounding communities, efforts have to be put in the way tourism is developed. Tourism cannot be assumed to develop by itself nor can it be assumed to benefit the MPAs' surrounding communities. For example, efforts have to be put into giving local communities the opportunity to have access to the main local tourist market, by helping advertising (see Malleret-King, 1998, Emerton, 1999).

The uncertainty surrounding tourism development would be even more acute in the case of the establishment of an NTZ. By definition, the location and the size of the NTZ would be determined by the characteristics of the fishing resource rather than by the aesthetic value of a reef, thus not necessarily favouring tourist-prone areas. These are important points to be taken into account when establishing a NTZ.

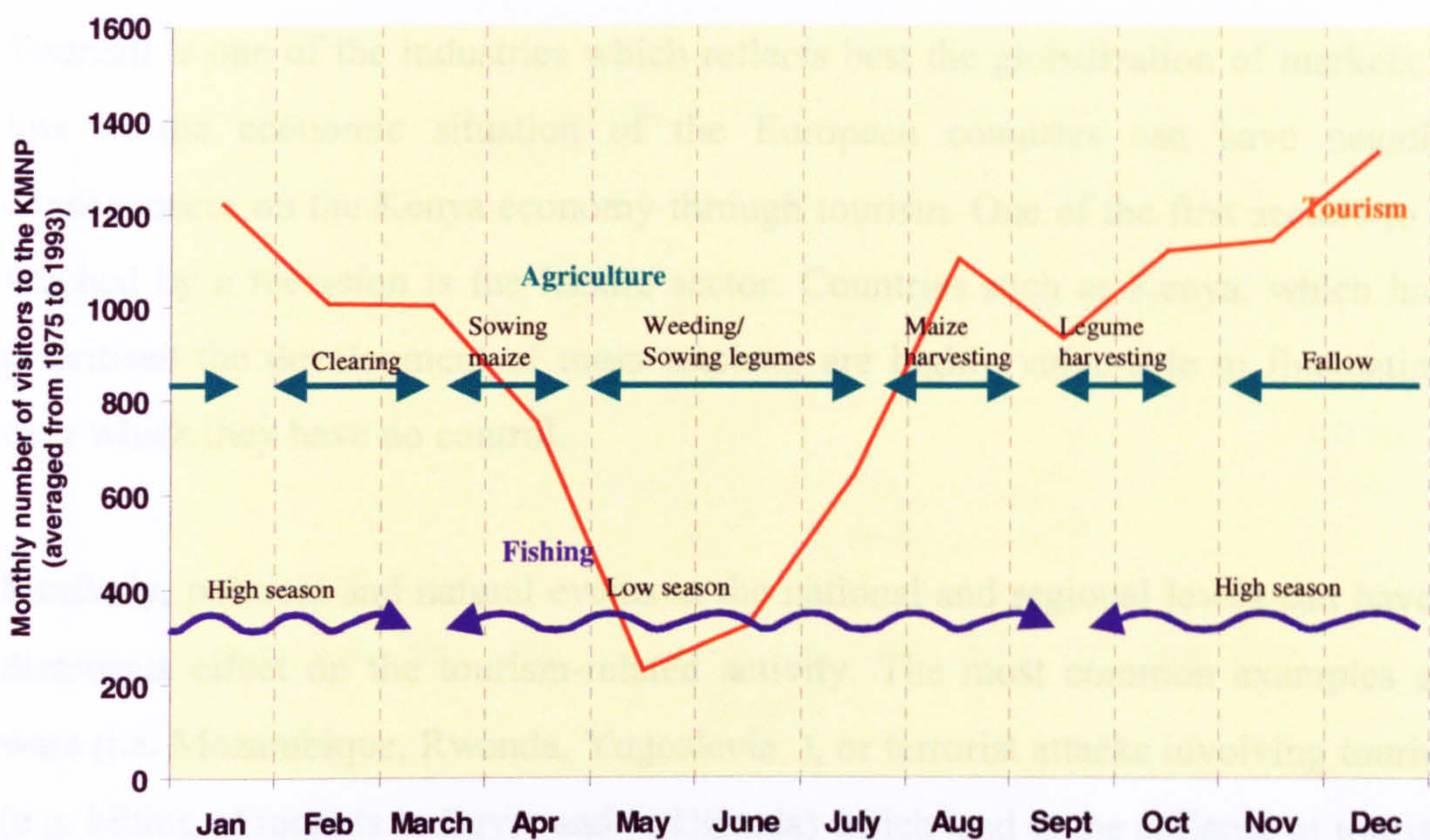
## **9.2.2 Fluctuations**

### **9.2.2.1 Seasonality**

Tourism is seasonal as are the other activities in the area (i.e. agriculture and fishing). Figure 9.10 summarises the seasonality of the activities and the monthly average (1975-1993) number of visitors to the KMNP and shows that tourism follows the same seasonal pattern.



### 9.2.2 Unpredictable events



**Figure 9.10: Seasonality of tourism, fishing and farming in the study area**

The low tourism season coincides with the hunger period in the farming activities and with the low fishing season (lower catch and difficult sea conditions). For small local boat operators it is thus essential that the high tourist season compensates for the opportunity cost of not fishing so that they have enough resources to cope through the low season. Employment by the larger tour operators can break this seasonal pattern. However, in most cases, if tourism is very low, staff is reduced. Although this might ensure the survival of the tour operators it means that young men employed in park-related tourism operations must not lose their knowledge of traditional activities (i.e. fishing) in order to support themselves if necessary.

The use of low price package tours and low hotel tariffs ensures that a minimum tourist flow exists. This flow is mainly directed towards the largest tour operators in the area and enables the maintenance of a minimum employment rate during the low season. Although the seasonal patterns are relatively predictable and lead to adaptive strategies (e.g. households depend on several activities), acute problems for the communities can occur if unforeseen events come to perturb this pattern, as was shown in the year of the fieldwork.



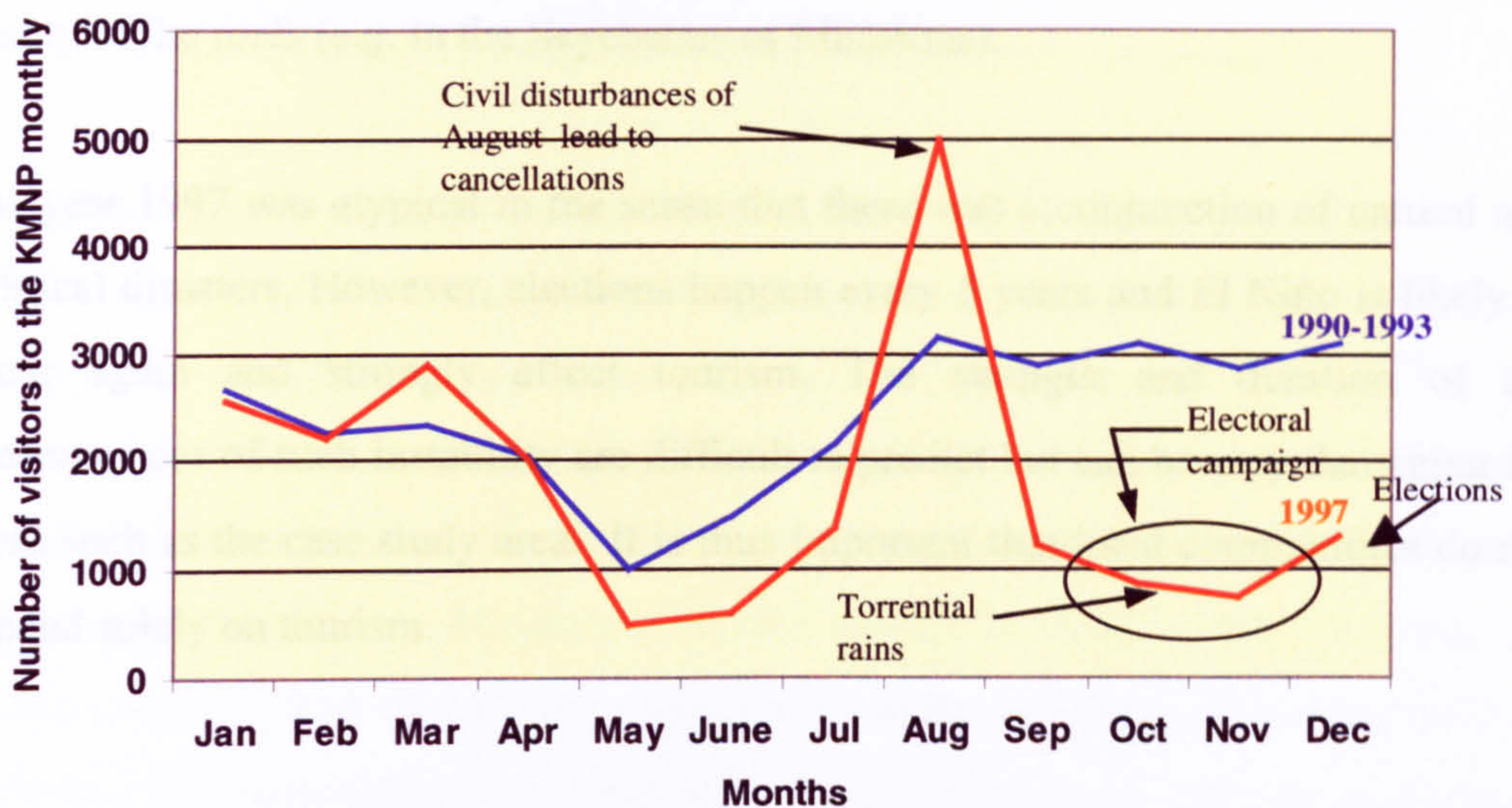
#### **9.2.2.2 Unpredictable events**

Tourism is one of the industries which reflects best the globalization of markets. A low in the economic situation of the European countries can have negative consequences on the Kenya economy through tourism. One of the first sectors to be touched by a recession is the leisure sector. Countries such as Kenya, which have prioritised the development of mass tourism, are highly vulnerable to fluctuations over which they have no control.

Similarly, political and natural events at the national and regional levels can have a disastrous effect on the tourism-related activity. The most common examples are wars (i.e. Mozambique, Rwanda, Yugoslavia..), or terrorist attacks involving tourists (e.g. killing of tourists in Egypt and in Uganda) which lead to the collapse of tourism for an unknown period of time. Uncertainty and instability without going as far as a war can have similar effects.

In 1997, a succession of events (see section 6.2.4.3) has had important negative consequences for tourism in Kenya and in the studied area. They showed the sensitivity of tourism and its volatility. These events included civil disturbances on the coast in August 1997 resulting in killing of several hundred people (tourists were not targeted), torrential rains in October 1997 due to the El Niño phenomenon resulting in the flooding of numerous areas in Kenya and in the breaking down of the road to Shimoni, the campaign for the presidential elections (middle of the high season) during which violence was expected. The figure 9.11 illustrates how these events one after the other disturbed the seasonal pattern of tourism in 1997.





**Figure 9.11: Seasonality of tourism and impacts of the events of the year 1997**

The civil disturbances led to the cancellations and repatriation of numerous tourists. Although tourists were protected, it is understandable that people did not want to appear in the midst of a conflict. The events of August resulted in the collapse of the number of KMNP visitors in September. The torrential rains of October 1997 cancelled all hope of recovery of tourism that year while a state of emergency was declared at the coast (see 6.2.4.3). The main road and the dirt road took two years to be repaired and graded (the dirt road was graded in 1999 only) which hinders a total recovery of tourism in the area. Although the events are long gone, their consequences were still felt in 1999 and according to several tour operators (pers. comm.), tourism in Kenya has not yet recovered from the year 1997.

The rains and El Niño have caused permanent bleaching of the coral reefs of the area including the ones in the KMNP, which might in time, deter park-related tourism. On the other hand, as shown earlier, although marine related reasons (including, the beach, the marine life etc.) are one of the most important in the choice for tourist coming to Wasini, the quality of the marine environment as such does not seem to be as important as other factors. Thus the damage to the reef might not reduce the



number of visitors in the short term as much as the bad state of the road. This might not be the case for other areas of the Indian Ocean where tourism rely more on the beauty of the reefs (e.g. in the Seychelles or Mauritius).

The year 1997 was atypical in the sense that there was a conjunction of natural and political disasters. However, elections happen every 5 years and El Niño is likely to occur again and strongly affect tourism. The strength and duration of the consequences of such instability are difficult to predict but can be very damaging for areas such as the case study area. It is thus important that local communities do not depend solely on tourism.

### **9.3 CONCLUSION**

Tourism has emerged as an important factor in understanding the situation of the studied communities in relation to the KMNP. The aim of this chapter was to examine further the effects of park-related tourism in the study area.

Although it was established that TMNP-dependent households were more food secure in the short term than households depending on other activities, no identified factors were found to explain the variability of the situation of the TMNP-dependent households (i.e. demographic, geographic, specific to the activity). One of the reasons for this is the small size of the sample. It is suggested that a purposive sample of TMNP households in each communities would have allowed to carry out a more complete study of the causes of variability among the households.

The effects of KMNP-related tourism were then investigated at the community, local and national levels. Using questionnaires and interviews it was established that the main benefits from KMNP-related tourism to the communities were employment and income, as well as aid projects. Further analysis showed however, that the distribution of benefits and costs of tourism were skewed. Most of the benefits are



shared by non-local tour operators at the local level, and the benefits going to the communities are mainly shared by three communities. The costs however are borne by all of the concerned communities and by the KMNP authorities.

The fact that park-related tourism was beneficial to the communities led me to raise the question of the sustainability of such a trade. Questionnaires and interviews suggested that the tourists were often not familiar with the concept of a MNP. However, this indicated that the KMNP was not advertised enough, not that the park did not enhance tourism use. The presence of tour operators that know of Kisite good quality reefs promotes tourism whether the tourists know of the KMNP or not. It was also suggested that tourism is seasonal and can be volatile in relation to unforeseen events. The seasonality of tourism is an important factor to take into consideration. Instead of compensating the seasonality of other coastal activities KMNP-related tourism accentuates it; the low season of tourism coincides with the low season in fishing and with the hunger period. This confirms the fact that households can rely fully on KMNP-related tourism only if the income they derive from it during the peak season is sufficient to survive during the low season. Otherwise, members of the households cannot afford to lose the knowledge of traditional activities.

The results showed that it could not be expected in all cases that tourism will automatically benefit the surrounding communities on a regular basis. In order for this to happen, an effort has to be made.

Similarly, in case of the establishment of an MPA or an NTZ, tourism has other costs than the direct economic costs (i.e. management costs, opportunity costs) such as the environmental and social costs which have to be taken into account as well and are mentioned in the conclusion (chapter 10).

Thus, tourism can benefit the communities around a MPA, and could be envisaged as an alternative activity in order to compensate for the loss of fishing grounds in the short term, and to reduce fishing pressure on the reefs. However, precautions have to be taken so that the benefit-sharing of tourism is equitable and that all affected communities get a share in it.



One aim of NTZs is to protect fishing resources. They are thought to be one of the solutions to overfishing in coral reef areas. This idea is based on the success or the perceived success of MPAs in ecological terms. Tourism is one of the main arguments, according to scientists and international agencies for surrounding communities to accept a reduction in their fishing grounds. However, this study showed that tourism does not develop automatically, most of all, in remote areas chosen for fishery management purposes rather than for tourism. Moreover, it cannot be assumed that surrounding communities will benefit enough unless efforts are made to involve them in the planning and the development of tourism (see also chapter 10).



## 10 CONCLUSIONS

### 10.1 THE ARGUMENT

Coral reef fisheries are mostly located in poor areas where people are dependent on them for survival. Classical fisheries management, based on open access to marine resources, which depend on difficult and expensive control measures to apply and rely on single species fisheries models; has not been successful in preventing the depletion of fisheries world-wide (including coral reef fisheries). The lack of knowledge, the uncertainties of the marine environment, the lack of political will and of financial resources, particularly in the developing world, have all contributed to the unsustainable use of fisheries resources. This has threatened the food security of numerous coastal communities world-wide who depend on fishing for their livelihood.

In recent years, it has been suggested that, by implementing the precautionary principle, NTZs could be a good solution to coral reef fisheries management problems. This idea emerged after the studies of the effects of established MPAs revealed that MPAs provided significant ecological benefits and were the source of economic benefits. One of main potential benefit of MPAs was thought to be their contribution to the improvement of the surrounding fisheries' yields through fish migration, protection of spawning stocks, increased recruitment and habitat protection (chapter 2).

Benefits on surrounding fisheries are however difficult to prove. Larval export benefits from marine protected areas will likely spread over large areas and are diffuse. These benefits are thus difficult to detect (Roberts and Polunin, 1991, Russ and Alcala, 1996a, 1996b). Moreover, examples of failed MPAs are numerous (Alder, 1996, Salm and Ngoile, 1998).

These failures are attributed to the lack of financial resources, the lack of political will, but also to the lack of involvement of the local communities in their



establishment, planning and management (White *et al.*, 1994, Borrini-Feyerabend, 1998). It was thought that, if authorities did not seek a consensus with the stakeholders, who often reject MPAs, their efficiency would be diminished and the costs of their enforcement would be increased (Borrini-Feyerabend, 1998). However, it is likely that fisheries managers need to understand the potential effects of NTZs on the surrounding communities if these are to be involved (and willing to be involved) in NTZs management and establishment.

To understand the effects of MPAs and subsequent NTZs from the communities' point of view, it is essential to have a good knowledge of the historical, socio-economic, cultural and political context of these communities. However, few studies concentrate on such aspects of MPAs. Moreover, the methods used to monitor MPAs' impacts on stakeholders such as SIA or cost/benefit analysis are not always appropriate or complete enough to fully assess MPAs' effects on the surrounding communities (see chapter 2). This vacuum does not only reduce the chances for managers to be able to involve stakeholders but is likely to have prevented them from knowing whether communities really (rather than theoretically) benefit from established MPAs. The aim of this study was thus to study the impact of an established MPA on surrounding stakeholders.

A household food security approach using household food coping strategies as an indicator was used. The concept of household food security has evolved in the last 30 years. It now encompasses elements of quantity, quality and access to food through food entitlements at the local level to provide a better understanding and detection of food crisis (Sen, 1981, Swift, 1989, Maxwell and Frankenberger, 1992, Maxwell, 1996, Maxwell, 1997). Being a more comprehensive concept, food security has become difficult to measure fully. If defined cautiously, coping strategies which are access indicators can give a good indication of risks of food insufficiency and of households' vulnerability (Nyborg and Haug, 1995, Maxwell, 1996).



My argument is that if it is necessary to involve stakeholders in the establishment and management of MPAs and subsequent NTZ (lowering the enforcement costs, improving compliance and tolerance) it would first be essential to have more information on the effects of MPAs from the point of view of the surrounding communities. This knowledge would increase the fisheries managers' capacity to design and enforce better suited fisheries management policies.

I chose to study the effects of a long established MPA in Southern Kenya, the Kisite Marine National Park (KMNP) on its surrounding fishing communities. To do this, qualitative and quantitative investigations were carried out. Helped by five research assistants from the studied communities, I examined the food security situation of 210 selected households. The quantitative analysis used household cumulative food coping indices calculated on the basis of coping strategies severity ranks and their frequency of use. Participatory methods were used as much as possible to ensure that the investigation was tailored to the local situation.

The hypothesis tested was that by enabling a better management of coral fisheries NTZs should improve the surrounding communities' food security situation. Thus, if the KMNP (where all extractive activities are forbidden) had benefited the surrounding stakeholders it would be reflected in their socio-economic situation (food security). To test this, I compared the situation of 5 fishing communities located at different distances of the KMNP.

## **10.2 RESULTS**

Even though it was established that the presence of the KMNP led to an increase in the abundance of certain species, in species diversity and in biomass inside the KMNP, no links were detected between the state of the fishery and the presence of the Park (Watson, 1996), nor were they disproved.



### 10.2.1 Qualitative investigation

The first step of the research was to discuss the evolution of the fishery and the KMNP with groups of fishers in each selected villages. The aim of these discussions was to gather background information on the KMNP, on the context in which it was established, on the structure of the fishery and its evolution and also to discover whether local fishers established any links between their fishery and the presence of the KMNP.

The results of these discussions were surprising. Only one group of fishers mentioned a potential contribution of the KMNP to the fishery; the fish caught were larger nearer the KMNP. The group identified this as an advantage of the KMNP. Generally, the fishers expressed discontentment towards the Park. The main advantage of the KMNP perceived is the aid that fishers associate with it (e.g. the gift of boats in 1995). Moreover, all the groups thought that the fishery had declined in the last 20 years (less catch per day per man; more effort is needed to catch the same amount of fish). No reliable statistics could confirm or reject their perception.

A lot of background information was gathered through these interviews, about the angry reactions of the communities to the establishment of KMNP, about the improvement of the relationship of the fishers with the park authority due to aid and compromises, about the evolution of the fishery and about the boats and the gear used. It was however important to get more objective information, particularly in the light of the fact that informants often have the idea that “before” is much better than “now”. The objectives of the quantitative analysis were thus to detect whether any relations between the households’ situation and identified KMNP-related parameters existed.



### 10.2.2 Quantitative investigation: general results

The food security based quantitative analysis relied on two short term (FCSI, STAI) and two long term indices (LTDI, LTAI) calculated for each of the 210 selected households. They reflected the coping capacity as well as the accumulation capacity of the surveyed households and were calculated by using the perceived severity of the strategies and a frequency scale. Strategies and their severity were identified through focus groups and in depth-interviews with women (see chapter 4). Factors which were likely to affect the households scores were examined. For part of the analysis, households needed to be divided into short term food security groups.

Demographic, geographic and socio-economic parameters were tested. The negative relationship between the household size and the scores confirmed the results of previous food security studies (Haddad *et al.*, 1994) and supported the idea that these indices could be a good measure of the socio-economic situation of the household. Although numerous relationships were identified, the two relationships with most importance were the strong correlation between economic activities and the scores, and the strong relationship between the socio-economic structure of the villages and the distance from the main employers (tourism). It was shown that the more households depended on fishing, the less food secure the group was and that, in contrary, the more TMNP-dependent households the more food secure. It was also shown that the nearer the households were to the main employer (KMNP-related) the more chances the household was to depend at least partly on tourism. In contrast, the further away from it, the more likely it was that the household depended at least partly on fishing.

No strong relationships were found between the distance of the villages from the KMNP and the households' scores but it was suspected that there was an indirect relationship between them through the socio-economic activities (particularly fishing and KMNP-related tourism). In order to have further understanding of what the



existing relationship between the household food security and the KMNP, more specific analyses were carried out.

### **10.2.3 Specific analysis: the KMNP and the Fishery**

To investigate the relationship between the KMNP and the fishery, fishing-dependent households (mainly dependent on fishing) were separated from the rest. Parameters thought to influence the households' scores were identified and relationships between these parameters and the scores were investigated. Thus, to the demographic, geographic and land use patterns parameters, elements linked to the households' fishing system were added. 105 households were identified as fishing-dependent. These were divided into short term food security groups for the purpose of the analysis.

The geographic parameters used in the analysis of the fishing households' food security were different from those used in the general analysis. The distances from the KMNP and the Reserve did not represent the routes used by the fishers but represented the shortest distance on the figure between the villages and the KMNP or Reserve boundaries. This was thought to affect the relationship between distances and the scores. On the basis of Watson's (1996) study which suggested that the patchiness of the reef might prevent some fish from migrating outside the KMNP, it was decided to take account of the distance of the villages' main fishing grounds (in the SE monsoon) from the KMNP boundaries and from the nearest protected reefs. The fishing zones were ranked according these distances.

The distance of the villages from the KMNP boundaries was not enough to explain the differences amongst fishing households. However it was found that short term and longer term coping capacities (LTDI and the FCSI) were affected negatively by the distances of the fishing zones from the protected reefs. These results were found despite existing confounded variables (participation in shifts and cultivation of



fields). Other results, which involved directly the KMNP, were the positive effect of the participation in shifts on the fishing households long term divestment score.

Thus the results suggested that the KMNP might have a spill-over effect was perceived by the community able to fish the nearest the protected reefs, thus by Kibuyuni. Moreover, the KMNP was found to have an effect on the situation of the fishing households through the aid it brought to the communities (i.e. the gift of boats).

#### **10.2.4 Specific results: the KMNP and tourism**

It was shown that the most food secure households in the short and long term were the ones depending mainly on KMNP-related tourism. Thus, tourism emerged as an important variable to understand the situation of the studied communities and particularly, KMNP-related tourism. It is often considered as one of the major benefits of the establishment of a MPA for the stakeholders (Dixon, 1993). The situation and the factors of variability influencing TMNP-dependent households were examined further. However, the lack of data points prevented a full and reliable statistical analysis to be undertaken.

In order to investigate the impact of the KMNP through tourism, a qualitative and an economic investigation were carried out. Important results were that the benefit-sharing of KMNP-related tourism is skewed, that the seasonality of tourism exacerbates the seasonal pattern of coastal activities and that tourism cannot be assumed to develop because a MPA is established. It was found that KMNP-related tourism created employment but that most of the benefits go to the non-local tour operators. The benefits are also unequally shared between the national and local level and amongst the local communities themselves (because of distance constraints). However the largest part of the costs including the cost of opportunity and the management costs which burdens the local level, and particularly the fishing communities.



It was also found that KMNP-related tourism was seasonal and volatile. The low tourism season corresponds to the hunger period and to the low fishing season on the coast. Thus, it means that TMNP-dependent households have to be able to accumulate enough resources during the high tourism season (they depend on the monetary income) to make it through the lower season. Otherwise the households need to spread the risk and depend on several activities and thus cannot afford to lose traditional knowledge (e.g. fishing nearshore for the SE monsoon).

Other findings about tourism in the study sites were that tourism could not be assumed to develop because of the presence of MPAs and that MPAs, most of all NTZs, could only be an attraction for tourists if these are aware of the difference of the reef inside and outside of a protected area.

## **10.3 LIMITS AND FURTHER RESEARCH**

### **10.3.1 Some of the limits of the research**

Most of the limits of the research were discussed in the relevant chapters. However, several points need to be reiterated.

My Swahili was sufficient to carry out the household surveys, the research assistants were a key to this research and the time spent in Kenya doing research before gave me a lot of background knowledge of the field and of the language. However, a lot of information was lost during informal discussions due to the language barrier.

One of the main limitations of the research was the impossibility of analysing the household food security over two seasons. This prevented me from finding patterns in the situation of households according to their land use patterns or their economic activities. It also prevented the verification of any potential differences, so important



to the fishers, of the fishing dependent households' situation between the two seasons. However, the natural and political events, which occurred at the time of the fieldwork, are likely to happen again and the study gives an insight of the consequences of such situations.

In terms of the analysis, one of the main drawbacks of the study has been the failure of the wealth-ranking process which would have enabled me to group households according to an external criterion, adding another control as was done by Maxwell (1996). However, the food security cumulative indices have been proved to be a reliable indicator of food security (Maxwell, 1996). Furthermore, the division into short term security groups taking account the accumulation and the coping strategy scores ensured a more balanced grouping factor (see chapter 7).

The presence of confounded variables led to difficulties as discussed in chapter 8. One of the main suspected factors of variability amongst fishing households was distances. However, the distances were not investigated in the field precisely, particularly the distances of the fishing grounds from the protected productive areas.

Furthermore, ethnicity, which is an important variable, was left aside during the analysis. As mentioned in chapter 3, three main ethnic groups were represented in the study site. These ethnic groups had different traditional activities, which could explain why some groups were better off than others. For example, the fact that in Wasini the people were traditionally traders might have influenced their capacity to adapt to new kinds of activities (e.g. KMNP-related tourism) or have influenced their long term scores. However, the two main ethnic groups (the Vumba and the Digo) dominate some of the villages. It is thus believed that by comparing scores across villages this difference was taken account of.

Finally, the lack of data points prevented an in-depth analysis of the parameters, which could affect the situation of the TMNP-households.



### 10.3.2 Suggestions for further research in the study site

Most of the following suggestions are linked to the limits of the research mentioned above.

- *In relation to the links between the fishing and the KMNP*

Other elements of parts of the ecosystem might have influenced the situation of the fishing households such as sea grass beds, on which several of the exploited species depend. Thus, further investigation of the location and characteristics of the fishing grounds used by fishers might reveal more precise effects of the park on the fishing communities' socio-economic situation. Overlaying maps of the characteristics of the fishing grounds and maps of food security scores could give information on a relationship between them. This could be done on a smaller scale.

The natural events of the year of the fieldwork have potentially affected the reefs of the Indian Ocean on a permanent basis by bleaching the coral. Research could concentrate on how this bleaching is going to affect the production system and food security of the KMNP surrounding communities, particularly the fishing households.

- *In relation to the tourism aspects of the KMNP*

Further analysis of TMNP-households' situation could contribute to detecting the conditions, which determine the situation of the households in relation to the KMNP-related tourism. This could be done through a purposive sample of the TMNP households and by doing a livelihood analysis of a small sample to detect the types of livelihood system reflected in the TMNP-households.

## 10.4 RELEVANCE TO OTHER SITUATIONS

It has been argued that results from studies based on participatory methods are not easily transferable (are not externally valid; see chapter 4). However, although the indices used in this research are based on local realities and local perceptions of



strategies’ severity, the method can be adapted to any other location. The quantitative results as such would not be able to be compared but the trends and patterns detected could be compared to other situations.

**10.4.1 Lessons learned**

The main benefits of MPAs are thought to come through the spill-over effect increasing the yield of the surrounding fisheries, and tourism employment providing economic opportunities and contributing to alleviate pressure on the reefs. Lessons have been learnt about the ways of investigating these benefits and about the constraints on these benefits.

**10.4.1.1 About the indicators**

The food security indicators provided information on the situation of the households in the different studied communities. They showed the differences across and within these communities. They also enabled me to identify some of the causes for these differences, particularly the differences linked to the presence of the KMNP.

Along with the results of the analysis, the strength of the household food security indicators was briefly investigated and compared in chapters 7 and 8. Tables 10.1 present the overall indices' strength scores. These were calculated by adding all the strength scores from the general analysis (table 7.26) and from the analysis of the fishing households (tables 8.22 and 8.23).

**Table 10.1: Indices ranked according to their overall strength - from stronger to weaker** (Derived from tables 7.26, 8.22 and 8.23)

Indices	Overall strength scores*	Ranks
FCSI	2.5	4
STAI	5.5	1
LTDI	3.75	3
LTAI	5	2
FCSI2	1.5	6
STAI2	2	5



Surprisingly, the ranks presented in table 10.1 show that the accumulation indices both long and short term (LTAI and STAI) were the most useful in this research. This confirms the idea, first mentioned in chapter 6, that, when households are not faced with a crisis, accumulation provided the larger amount of information. They allowed a discrimination to be made amongst households.

In contrast, but as expected, the second round indicators were the least useful. This is probably due to the unreliability and the incomplete second round of household survey.

This study shows that food security indicators are good tools to compare the households' situation and to investigate the causes of these differences. They enabled me to examine from the stakeholders' point of view the benefits of the KMNP. However, the rough measurement of the indices' strength also shows that long term, short term, accumulation, coping and divestment indicators provide a different amount and diversity of information. It was thus important to use a range of indicators.

#### **10.4.1.2 Constraint to the benefits in terms of fishing**

MPAs and NTZs are not homogenous nor is their accessibility to stakeholders. The impact that the heterogeneity of an MPA can have on the fish migration was detected in Barbados and Kisite (Rakitin and Kramer, 1996, Watson, 1996). Furthermore, eddies, current patterns and the underwater features are all known to affect the larval dispersion thence the recruitment outside MPAs (Man *et al.*, 1995, Lauck *et al.*, 1998, Allison *et al.*, 1998). This study shows how the heterogeneity may also affect the way in which surrounding stakeholders benefit from resource protection. Access to the proximity of productive protected areas is a limiting factor for the communities to perceive the benefits of an MPA. Thus, it cannot be assumed that by creating NTZs, all the communities affected by their establishment through decreased fishing grounds will benefit from it. Compensatory measures have to be



thought about or ways of sharing other benefits need to be defined for communities to tolerate and participate in the management of MPAs and subsequent NTZs.

#### **10.4.1.3 Limits to the tourism ‘miracle’**

Heterogeneity is also the major limiting factor in terms of tourism. Thus, although the costs of opportunity may be shared by a wide range of communities, MPA-related tourism benefits might not. The problem of skewed benefit sharing in the KMNP is likely to be even more acute in the case of the establishment of new NTZs, as these will not be designed for tourism only. Distance is an important limiting factor. Furthermore, this study showed that efforts have to be put in the way tourism is developed if all stakeholders are to benefit from it.

Education and tourism information in the guest and host countries might be key to the better benefit sharing of tourism benefits at the local level (for example between the local and non-local operators). Financial tools, promoting the involvement and a better sharing of the profits with local communities might also need to be designed (see Emerton, 1999).

In most situations, households have a range of options of activities. Tourism might only be one of the options, which could partly contribute to alleviating the pressure on the coral reefs. Another option is subsistence farming for example and looking at how a change in land tenure, or improved farming methods can alleviate pressure on the reefs (see Malleret-King, 1996, King, 2000) is essential. This is most important when relying only on tourism for economic benefits and for reducing pressure on the reefs has not brought the benefits expected and can be an extremely risky trend. The volatility in a the context of global markets, the environmental and the social cost of tourism all contribute to the problems experienced in different parts of the world.



#### **10.4.1.4 Environmental sustainability of tourism and NTZs**

With the increase of tourism in coral reef areas (Price *et al.*, 1998), its direct and indirect environmental impacts on coral reefs have been widely studied (Beeckhuis, 1981, Ormond, 1982, Hawkins and Roberts, 1992, 1993, 1994, Price and Firaq, 1996).

Indirect impacts include the added pollution exacerbating existing problems on congested coasts (IUCN, 1993), and also the creation of markets for coastal products accentuating the decline of already overexploited marine products (Polunin and Roberts, 1996, Glaesel, 1997).

Direct effects of tourism include anchoring, trampling, shell and marine organisms collecting. Trampling on coral reefs (Woodland, and Hooper, 1977; Kay and Liddle, 1987, 1989, Hawkins and Roberts, 1992; Hawkins and Roberts, 1993) has been shown to affect the coral population structure of the reef flat (Hawkins and Roberts, 1993) and the coral community composition (Kay and Liddle, 1989). It is also suggested that trampling damage inflicted by snorkelers could be worse than trampling inflicted by walking on the reef flats (Hawkins and Roberts, 1993) as the damage is more patchy and widespread (snorkellers swim and then stand wherever they are). Furthermore, by gliding over the reefs, divers can cause abrasions which makes the coral more sensitive to diseases. By kicking, holding, kneeling, standing or trampling on benthic organisms, divers and snorkellers also damage the reef ecosystem (Hawkins and Roberts, 1992). This was noticed in the KMNP (Anon., 1993, Muthiga and McClanahan, 1997).

A study of the substrate type and of the coral damage in the KMNP, has shown that the damage due to recreational activities was much more visible in the deeper than in the shallower areas, suggesting that snorkelling caused stronger damage than diving or that the substrate is more robust in deeper waters (Muthiga and McClanahan, 1997). The same study also suggests that fish feeding activities are disturbed by tourists' presence.



The environmental carrying capacity of MPAs is often taken into consideration and more and more, actions are taken to reduce the impact of marine recreational activities. Tourists have to be educated. In Kisite for example, anchoring on the reef is forbidden and mooring buoys are provided. Information is given to tourists on boats to increase their awareness of the damage they can cause to the ecosystems. Tourists are told not to collect any living marine organisms (they can be fined) and fins are not provided to inexperienced snorkelers. When creating NTZs in a coral reef area with the aim of developing recreational activities, these strategies have to be developed so as to make it sustainable environmentally.

#### **10.4.1.5 Cultural sustainability of tourism and NTZs**

Behaviours such as children begging for sweets or pens in the study sites are considered as a direct impact of tourism. Other impacts were not studied but because of the low development of tourism and of the fact that tourists are mainly day-trippers in the area, these are suspected to be minimal. However, the socio-cultural impacts of tourism are of increasing concern as mass tourism takes its toll on numerous destinations (Cater and Lowman, 1994, Shaw and Williams, 1994, Lesley, 1997, Robinson, 1999). Often, under the influence of tourism, local cultures reinvent themselves in order to fit the tourism and purchasing power's exigencies (Lesley, 1997, Robinson, 1999). This has been particularly observed in the Caribbean where some local islands have taken on traditions of other more popular islands to fulfill tourists expectations of what a Caribbean island should be like (Smith, 1997).

Implications of tourism, even more so of mass tourism, are numerous on the social scene. The meeting of different cultures can lead to the conflicts of values (e.g. moral and economic versus only economic; Glaesel, 1997). The development of the tourism industry can lead to the reshaping of the local economic scene and thus to the associated social structure, to the displacement of populations and changes in land use patterns and to the development of side trades such as prostitution or drugs (Malleret-King, 1996, Glaesel, 1997, Hall, 1997, Lesley, 1997).



In Kenya, tourism has reduced people's access to land by creating an international land market (Ng'weno, 1995, Malleret-King, 1996, see chapter 3). When tourism was developed in Kenya, little attention was given to the coastal traditions and culture. For example, the reduced access to the beach has limited the areas where fishing communities can perform their traditional rituals and made some of the sacred sites inaccessible (Glaesel, 1997). Economic power is becoming more and more important and elders have lost their advisory powers (Glaesel, 1997).

A community's involvement in MPA establishment and management is increasingly accepted in order for them to be enforced (chapter 2). At the same time, the question of the social sustainability of tourism has led to the suggestion that local communities should also be actively involved in tourism development (Robinson, 1999). For example, communities could have a say in what they feel is acceptable or not for tourists to have access to. Examples in Canada, Australia, Namibia or Venezuela (Blangy, 1999, Marchant, 1999) show how tourism can be developed in conjunction with the wishes of local people. They decide where they take the tourists and what they are willing to share with them.

When establishing NTZs in coral reef areas with the aim of making it a tourist attraction, the environmental and social impacts of tourism must be considered. The issues and designs should be discussed with the affected communities in order also for them to have realistic expectations and to define what is acceptable and what is not.

These two aspects were not central in the study but they cannot be forgotten. Tourists and hosts have to be acknowledging their rights as well as their duties. For example, tourists have to be made aware of the offenses they may cause to the local cultures<sup>23</sup> (Reisinger, 1997, Smith, 1997). It is the case in Wasini where the tour

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<sup>23</sup> UNESCO, UNEP, the World Tourism Organisation, the World Bank, UNDP, experts, private business are involved in a partnership in order to bring culturally more sensitive policies. Particularly for tourists to increase their understanding and for "*communities to participate and benefit from the development of tourism*" (UNESCO, 1999: 52).



operators forbid tourists to walk around in offensive clothes to the local Muslim population.

This study shows that relationships between the stakeholders and MPAs are complex. Factors such as distance or aid can determine whether surrounding communities will benefit from the establishment of MPAs or subsequent NTZs. This is the case for benefits in terms of fishing and tourism. As suggested, tourism cannot be considered as the panacea to reduce pressure on the reef or to compensate for the loss of fishing grounds. But conversely, it is clear that in today's globalisation NTZ managers cannot afford to ignore tourism as an alternative activity. However, there needs to be conscious planning and efforts for NTZ-related tourism in coral reef areas to include the surrounding communities in the benefit sharing and in the decision of the type of tourism the communities are prepared to accept.



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## PERSONAL COMMUNICATIONS

<b>Diani Fisheries Officers</b>	Fisheries Officers at the time (1996): Mr Beja and Mr. Mwangare.
<b>Fisheries Director</b>	Assistant Director Fisheries, Fisheries Departement, Mombasa. At the time (1997): Mr. Oduol.
<b>King, A.</b>	University of Warwick, undertaking a PhD (at the time) on governance of natural resources
<b>Muthiga, Dr. N</b>	At the time (1997), Senior Marine Scientist. Kenya Wildlife Service, Mombasa.
<b>Tour Operators</b>	They were at the time (1999) the Shimoni non-local tour operators described in chapter 9 interviewed in 1997-1998.
<b>Warden</b>	Kisite Mpunguti Marine National Park and Reserve Warden 1996/1997. At the time (1997): Mr Odeny.



## **Appendix 1: List of Acronyms**

### **Organisations/Institutions/ Conferences:**

<b>FAO</b>	Food and Agricultural Organisation
<b>GATT</b>	General Agreement on Tariffs and Trade
<b>IFPRI</b>	International Food Policy Research Institute
<b>IMF</b>	International Monetary Fund
<b>IUCN</b>	International Union for the Conservation of Nature
<b>KWS</b>	Kenya Wildlife Service which is a para-statal organisation responsible for the management of parks and reserves in Kenya.
<b>OECD</b>	Organisation for Co-operation and Economic Development
<b>UNCED</b>	United Nations Conference on Environment and Development
<b>UNCLOS</b>	United Nations Convention on the Law of the Sea
<b>UNEP</b>	United Nations Environment Programme
<b>UNESCO</b>	United Nations Convention for Education and Culture??
<b>WFS</b>	World Food Summit
<b>WHO</b>	World Health Organisation
<b>WTO</b>	World Trade Organisation
<b>WWF</b>	World Wildlife Fund

### **General:**

<b>EWS</b>	Early Warning Systems: systems developed in the 1970s and relying on the observation of several food supply indicators to detect potential food crises early.
<b>PA</b>	Protected Area
<b>SL</b>	Single Large
<b>SLOSS</b>	Single Large or Several Small: referring to the debate about whether terrestrial protected areas would be more effective if a single large one was established or several small. The debate is now extended to MPAs



**SS**                      Several Small

**Methodology:**

**PRA**                      Participatory Rural Appraisal  
**RRA**                      Rapid Rural Appraisal  
**WID**                      Women in Development

**Marine related terms:**

**EEZ**                      Exclusive Economic Zone  
**KMNP**                      Kisite Marine National Park  
**MNP**                      Marine National Park: in a Kenyan MNP all extractive activities are forbidden  
**MNR**                      Marine National Reserve: in a Kenyan MNR, only traditional fishing methods are allowed  
**MPA**                      Marine Protected Area  
**MSY**                      Maximum Sustainable Yield  
**NTZ**                      No Take Zone: a NTZ is a marine area where all extractive activities are forbidden with the aim of promoting the sustainable use of fishing resources.  
**TMNP**                      Tourism linked to the presence of the KMNP

**Index related terms:**

**Adaptive strategies**                      strategies used by households on a permanent basis which have been integrated in the households' new livelihood system.  
**Coping strategies**                      strategies used by households temporarily to cope with a food crises, on a short term basis. When coping strategies are used in the long term they have become adaptive strategies.



<b>FCSI</b>	Food Coping Strategy Index: cumulative index reflecting the capacity of the households to cope with a crisis in the short term.
<b>LTAI</b>	Long Term Accumulation Index: the LTAI reflects the households' capacity to accumulate assets in the last ten or twenty years.
<b>LTDI</b>	Long Term Divestment Index: the LTDI reflects the incapacity of the households to cope with events and their obligation to sell assets which might be affecting the maintenance of their livelihood system.
<b>STAI</b>	Short Term Accumulation Index: the STAI reflects the households' capacity to accumulate in the short term.
<b>VL</b>	Very Low: the VL refers to the households the least food secure when the households are divided into short term food security (average of the STAI and FCSI) quartiles.
<b>LM</b>	Low Medium: refers to the households belonging to the second quartile in terms of short term food security.
<b>MH</b>	Medium High: refers to the households of the third quartile in terms of short term food security.
<b>H</b>	High: refers to the households the most food secure, belonging to the fourth quartile in terms of short term food security.



## **Appendix 2: Focus groups on the KMNP**

The focus groups were composed of 4 to 10 fishers from middle-aged to old. Their aim was to understand better the feeling of the fishers towards the KMNP, established 20 years before the interview. The sets of questions were divided into themes and the guideline questions are presented below.

### **1. The KMNP and the surrounding communities**

- 1.1. Could you tell me the history of the KMNP and the Reserve? (when and how it was established)
- 1.2. Why did you think the location of the KMNP was chosen where it is?
- 1.3. Have you noticed any changes since the KMNP has been established in terms of the seascape?
- 1.4. What was the reaction of the surrounding communities when the KMNP was established and then the Reserve? Why?
- 1.5. What do you think about the KMNP now?
- 1.6. Could you list the advantages and disadvantages of the KMNP as you perceive them? (the results were summarised in a table presented in chapter 5).

### **2. KWS and the communities**

- 2.1. Do you ever see people fishing in the KMNP, or fishing in the Reserve with illegal gear?
- 2.2. What is the role of KWS in the KMNP and in the Reserve? What is their work?
- 2.3. What kind of relationship does the community have with KWS? Do you have contacts? In which circumstances?

The questions above just give an indication of the type of themes and points the groups were set up to answer rather than the precise questions asked. According to the situation and groups, the questions varied. The groups were led in Swahili thus these guidelines were first translated into Swahili.



Appendix 3: Focus group on the fishery

The groups were composed of four to ten fishers predominantly middle aged and old fishers. The aim was to get information on the fishery, the gear, the boats, the fishing grounds and the rules by which the fishers exploit the resources. One of the underlying objectives was to investigate whether the fishers when presenting their fishery, would identify a link between the fishery evolution and the presence of the KMNP. The results of these focus groups are presented in chapter 5. This appendix presents the themes and sets of questions which guided the discussions, and examples of the way in which the results were processed.

1. Description of the fishery

1.1. Gear, catch and seasonality

The gear used in the village, the number of fishers using each gear and the type of species fished with each specific gear was first discussed. The seasonality of the gear and of the catch is also mentioned: which gear is used in which season and which species are targeted. Finally, fishers were also asked to estimate the catch per boat in each season and gear when possible. The results of these discussions were summarised in tables as shown in the following examples.

Table 1: Fish targeted per gear, per season and the estimated number of fishers using each gear in each village. (focus groups)

Anzwani					
Gear/Season	Use of gear		Main type of fish		Number of fishers
	<i>Kusi*</i>	<i>Kaskasi</i>	<i>Kusi</i>	<i>Kaskasi**</i>	
Handline	yes	yes	Emperor	Snapper	all. (40)
Traps	yes	yes	Prawns	Rabbit fish	all. (40)
Tidal weirs	yes	no	Grunt Sweetlips		15
Gill nets	yes	yes	Kingfish other pelagics	Shark	10
Spears	yes	yes	Octopus		10
Spearguns	yes	yes	Reef fish		2-3

\**Kusi*: South East monsoon  
\*\* *Kaskasi*: North East monsoon



**Table 2: Example of information on the catch per day per season for the main gear**

<b>Kibuyuni</b>		
<b>Gear/type of boat</b>	<b><i>Kusi</i>: kg of fish/boat</b>	<b><i>Kaskasi</i>: kg of fish/boat</b>
<b>canoe (handlines/Traps)</b>	0-20	20-50
<b>Tidal weir</b>	20-50	5-10
<b>Octopus</b>	2-3	

**Table 3: Example of information gathered on the types and number of boats in villages**

<b>Kichangani</b>		
<b>Type of boat</b>	<b>Number</b>	<b>Number of fishers/boat</b>
<b>canoes</b>	lots	3
<b>Outriggered canoes</b>	3	3
<b>Motored boats</b>	9	4
<b>Dhows</b>	4	4
<b>KWS boats</b>	2	5

**1.2 Fishing areas**

The fishers were asked to make maps of the main fishing grounds of the village, indicating the time necessary to get there in the appropriate season and the type of grounds it was: substrate, depth (deep, not deep maybe exposed at low tide). The information was summarised in tables as well showing that the grounds mostly used are coral reef substrate and not too deep.



**Table 4: Example of information on the fishing grounds used by fishers**

<b>Kijiweni</b>				
<b>Names</b>	<b>Minutes travel</b>	<b>Substrate</b>	<b>Depth</b>	<b>Season</b>
Nyuli	2 - 3 h (paddling)	reef	Deep	<i>Kaskasi</i>
Mpunguti		reef islet	shallow heads and deep	<i>Kaskasi</i>
Chiwa		reef	idem	<i>Kusi</i>
Mwambamku		reef flat...	shallow	both
Midira		reef	Shallow and deep	<i>Kaskasi</i>
Si	120 (paddling)	reef islet	Shallow and Deep	<i>Kaskasi</i>
Mwiwa	60 (paddling)	reef	idem	both
Tanzale	30 (paddling)	reef flat	no shallow	<i>Kusi</i>

Furthermore, fishers were asked whether there were sacred areas and if any what type of areas they were such as coral heads, caves, and where they were located.

**1.3 Fisheries management**

The groups were asked to describe the rules which affect them in terms of fisheries management. They were asked to list forbidden things related to fishing. Then they were asked whether there were forbidden practices, not by the Fisheries Department but by the fishers themselves.

**2. History and evolution**

**2.1 Problems**

Fishers were asked to discuss the problems they have in terms of fishing. If there were any problems, what were they? Most of them answered that there was not enough fish.

**2.2 Evolution**



This theme enabled me to understand the way in which the fishers perceived the fishery evolution. They were basically asked to list the main differences between *zamani* and today in the fishery.

**Table 5: Example of comparison between *zamani* and now**

Mkwiro	
BEFORE	NOW
No KMNP People were growing millet  Were fishing and selling dried fish to Mombasa; one man was walking to the town Fish price low Lots of fish, fish nearer Less fishers Tide higher, used to touch the baobabs	KMNP Now not interesting to farm because: cows and goats are left free Fish mongers  high price Not so much fish 80% more fishers Now lower

The discussion ended with a question about the young men, whether they wanted to become fishers or not and why.



#### **Appendix 4: Semi-structured interview with the fishmonger**

The key informant was a fishmonger at the time of the research. He also had been the chief of the fishermen's cooperative of Shimoni which collapsed in the 1970s. The aim of the interview was to gather information about the fishery from the point of view of the other end of the sector (distribution and commercialisation rather than from the producers). The Senior Fisheries Officer's assistant, Mr. Amani, acted as a translator and facilitator in this interview.

1. What kind of fish do you get mostly nowadays?
2. Does it differ from the fish you mostly got *zamani* (before in history)?
3. Do you think the number of fishers has varied since you can remember? In what way? Can you describe the changes for Anzwani, Mkwiro, Wasini, Kibuyuni and Kichangani?
4. How many kilos of fish do you usually get to buy nowadays on average?
5. How many could you get before?
6. Do you remember in the years that you have been selling fish a very good year for fish? Which year and why?
7. Do you remember very bad years for fish? Which year? Why?

These questions only present the themes discussed with the fishmonger but the interview being quite informal a lot more information was discussed such as the Wapemba fishermen (migrant seine net fishers) and their influence on the fishing.



## **Appendix 5: Severity ranking**

Each village group ranked the short term, long term, coping and accumulation strategies according to their perceived severity. For some strategies, the perceived severity varied. The indices were to be calculated on the basis of the severity and the frequency of use of each strategy. Thus, these differences in the ranking raised the question of which ranking was the most appropriate to use in the indices calculation. As shown below, with the example of the short term food coping strategies, several options were tried before choosing the median rank as the most appropriate one.

It was thought that by using the groups' ranking it would be possible to take account of socio-cultural differences. However, it was also believed that some of the differences might have come from difficulties to rank all the strategies which were sometimes very seldom used in the communities. For example, in Wasini selling and being gold or jewellery was mentioned whereas in the other villages, this was mentioned but never used it was thus difficult to rank for the groups.

The possibility of ranking the strategies according to their use in a community was also examined. This was thought to be able to eliminate the possibility of the groups' misunderstanding for some of the strategies. To rank the strategies according their use, the frequency of use of each strategy was summed in each village, averaged at the village level and then ranked. The assumption was that the more a strategy is used the less severe it must be in the case of coping strategy or, the less good in terms of accumulation. However, the socio-cultural or environmental constraint introduced a bias. For example, in Wasini very few households had chickens as they often felt that chickens or goats could not be kept, that they ran away in the bush. Thus, they did not sell chickens often not because it was such a severe strategy but because they did not buy them.



The median ranks based on the groups’ ranking were then thought to be the most appropriate solution and used as the severity ranking for all the communities. Median ranks would take into account the differences across villages but also reduce the distortion due to the mistakes and misunderstanding. Tables 1, 2, 3 show the example for the food coping strategies rankings.

**Table 1: The coping strategies severity ranking as perceived in each village (1).**

Strategies	Wasini	Kichangani	Anzwani	Mkwiro	Kibuyuni
Buy less food	1	1	1.5*	1	1
Sell chicken	2	2	1.5	5	4.5
Skip a meal	3	5	4.5	2	3
Porridge	4	6	6	3	2.5
Feed only children	5	3	6	4	5
Credit at shop	6	4	3.5	7	6
Borrow from family	7	7	5	6	7
No food for a day	8	8	8	8	7

\*The severity ranking for Anzwani, Kibuyuni and Wasini represent the median ranks of several focus groups organised to rank the strategies. These groups corresponded to the different hamlets composing the communities.

To rank according the frequency of use, the mean frequency for each strategy was calculated. The means were then ranked (descending) so that the less a strategy was used the more severe it was considered to be.

**Table 2: The coping strategies severity ranked according to their frequencies for each village (2).**

Strategies	Wasini	Kichangani	Anzwani	Mkwiro	Kibuyuni
Buy less food	1	1	1	1	4
Sell chicken	8	7	8	7	7
Skip a meal	3	2	2	2	2
Porridge	4	3	4	4	3
Feed only children	4	4	7	5	5
Credit at shop	2	5	3	3	4
Borrow from family	4	6	5	6	5
No food for a day	7	8	6	8	8



**Table 3: The coping strategies median rank (3)**

Strategies	Ranks
Buy less food	1
Sell chicken	2
Skip a meal	3
Porridge	4
Feed only children	5
Credit at shop	6
Borrow from family	7
No food for a day	8

Although the median ranking option seemed to be the most appropriate it was necessary to check that the different options did not lead to very strong differences in the scores. Paired sample t-tests were carried out to compare for each household, the scores obtained with the three different strategy rankings (1: community scores, 2: according to frequency, 3: median rank). The scores were thus treated as pre-test, post-test experiments (Argyrous, 1997).

**Table 4: Results of the paired samples t-test testing the difference of household scores in each community according to the severity ranking**

Community	t-test (1; 2)		t-test (2; 3)		t-test (1;3)		N
	t	p	t	p	t	p	
Wasini	11.23	p<0.05	-11.23	p<0.05	0	NS	47
Kichangani	-7.44	p<0.05	6.91	p<0.05	-3.85	p<0.05	26
Anzwani	-9.48	p<0.05	7.86	p<0.05	-2.14	p<0.05	47
Mkwiro	-8.15	p<0.05	11.81	p<0.05	6.05	p<0.05	50
Kibuyuni	1.92	NS	0.68	P<0.05	5.3	p<0.05	41
All.	-3.22	p<0.05	3.63	p<0.05	0.66	NS	211

The results presented in table 4 suggest that in most cases, the scores differ strongly according to the rankings (p<0.05). However, although the significant difference of the scores in absolute terms was expected, the most important was to examine whether the households' ranks were strongly affected within their villages (difference in relative terms).



To do this, the households were ranked according to their score in each village and a Friedman two-way analysis of Variance was carried to look at the difference between the ranks of the households corresponding to the three different severity ranking.

**Table 5: Friedman Two-Way analysis of Variance investigating the difference between the ranks of each households within their village and within the whole population according to the different severity ranking of the coping strategies.**

<b>Friedman Test Statistic</b>	<b>FTS</b>	<b>Probability <math>\alpha=0.05</math></b>	<b>N</b>
<b>Wasini</b>	0.000	NS	47
<b>Kichangani</b>	0.692	NS	26
<b>Anzwani</b>	1.032	NS	47
<b>Mkwiro</b>	0.070	NS	50
<b>Kibuyuni</b>	0.049	NS	41
<b>All.</b>	3.419	NS	211

The results presented in the table 5 show that although the FCSI is significantly affected by a change in the severity ranking in absolute terms, the ranking of the households in each community was not significantly affected. The Friedman test showed that the ranks of the households did not differ significantly according to the strategy ranking.

Knowing that the relative position of the households in each village was not affected significantly by the change in ranks, it was suggested that the most appropriate severity ranking to use in the score calculation was the median rank. It enables comparisons to be made, takes account of socio-cultural differences between communities and helps reducing the distortions due to mistakes.



Appendix 6: Basic matrix for the shotgun analysis of the households situation

Table: Characteristics and scores of the surveyed households aggregated at the short term food security group

PARAMETERS															
		Scores					Demographic			Economic activities					
Groups	FCSI	FCSI2	STAI	STAI2	LTDI	LTAI	Household Size (mean)	Mean active members	Dependants (mean)	Fishers (%)	TMNP (%)	T.Other (%)	Labour (%)	Qualified (%)	Other (%)
Wasini	VL	132.25	158.11	12.83	12.22	119.08	53.09	1.25	4.64	33.33	26.67	6.67	0.00	13.33	20.00
	ML	156.30	164.83	12.05	14.33	130.60	56.30	1.45	6.80	13.79	31.00	0.00	0.00	13.79	41.38
	MH	172.70	169.81	14.75	13.75	135.22	63.22	1.30	4.90	6.67	33.33	6.67	0.00	13.33	40.00
	H	180.00	171.20	16.58	17.10	139.42	65.70	1.04	4.64	0.00	38.10	19.05	0.00	0.00	42.86
	Mean	160.50	166.54	14.11	14.38	131.11	59.71	1.24	5.26	13.80	30.20	8.60	0.00	10.30	37.10
Kichangani	VL	114.00	128.14	12.29	11.00	96.14	62.43	1.14	5.71	37.50	12.50	12.50	0.00	25.00	12.50
	ML	129.67	140.75	10.83	11.25	112.33	48.83	1.50	4.28	55.55	11.11	0.00	11.11	22.22	0.00
	MH	138.17	144.20	10.75	11.00	116.00	55.17	1.75	3.56	52.38	14.28	0.00	23.81	0.00	9.52
	H	162.00	155.33	11.29	12.67	120.71	71.29	1.93	4.50	33.33	22.22	0.00	29.62	7.41	7.41
	Mean	136.12	141.50	11.33	11.50	111.08	60.00	1.58	4.56	43.90	15.80	2.40	18.30	12.20	7.30
Anzwani	VL	113.50	167.46	10.42	13.64	99.58	47.33	1.17	6.42	71.41	0.00	0.00	0.00	0.00	28.56
	ML	134.00	170.50	11.17	13.40	100.78	52.40	1.30	5.30	93.33	0.00	0.00	0.00	0.00	6.67
	MH	149.46	169.92	12.30	12.90	116.18	54.39	1.73	4.23	68.28	4.88	4.88	9.75	0.00	12.19
	H	169.83	171.64	12.88	14.91	107.33	64.33	1.42	4.48	49.99	5.89	23.52	0.00	5.89	12.19
	Mean	142.19	169.87	11.72	13.69	106.09	54.70	1.41	5.08	69.90	3.00	7.50	3.00	1.50	15.00



Table (continued): Characteristics and scores of the surveyed households aggregated at the short term food security group

PARAMETERS											
Groups	Land use			Land assets		Geographic					
	Cultivating (%)	Garden (%)	Field (%)	Individual (%)	Family (%)	D.KMNP (km)	D.Reserve (km)	D.Employer (km)	D.Employer (minutes)	D.Shimoni (km)	D.Shimoni (minutes)
Wasini	VL	9.10	9.10	0.00	9.10	18.20	4.00	0.50	5.00	2	20
	ML	10.00	10.00	0.00	10.00	10.00	4.00	0.50	5.00	2	20
	MH	11.10	11.10	0.00	22.00	0.00	4.00	0.50	5.00	2	20
	H	8.33	8.33	0.00	25.00	0.00	4.00	0.50	5.00	2	20
	Mean	9.30	9.30	0.00	16.30	7.00	4.00	0.50	5.00	2	20
Kichangani	VL	28.60	14.30	14.30	0.00	0.00	6.50	3.00	25.00	1	10
	ML	66.66	33.33	33.33	0.00	0.00	6.50	3.00	25.00	1	10
	MH	66.70	66.70	0.00	33.30	0.00	6.50	3.00	25.00	1	10
	H	71.40	57.10	14.30	14.30	14.30	6.50	3.00	25.00	1	10
	Mean	57.70	42.30	15.40	19.20	3.80	6.50	3.00	25.00	1	10
Anzwani	VL	58.30	58.30	0.00	8.30	0.00	8.00	4.50	40.00	2.5	25
	ML	66.66	58.33	8.33	10.00	0.00	8.00	4.50	40.00	2.5	25
	MH	72.70	54.50	18.20	23.10	0.00	8.00	4.50	40.00	2.5	25
	H	75.00	66.70	8.30	16.70	0.00	8.00	4.50	40.00	2.5	25
	Mean	68.10	59.60	8.50	14.90	0.00	8.00	4.50	40.00	2.5	25



Table (continued): Characteristics and scores of the surveyed households aggregated at the short term food security group

PARAMETERS															
Scores			Demographic					Economic activities							
Groups	FCSI	FCSI2	STAI	STAI2	LTDI	LTAI	Household Size (mean)	Mean active members	Dependants (mean)	Fishers (%)	TMNP (%)	T.Other (%)	Labour (%)	Qualified (%)	Other (%)
Mkwiro	VL	122.92	150.08	10.62	10.92	104.15	63.85	1.23	5.60	56.25	9.37	12.50	9.37	0.00	12.50
	ML	146.75	162.91	11.25	12.73	110.46	67.82	1.25	6.00	86.67	6.67	0.00	0.00	0.00	6.67
	MH	158.25	164.40	15.00	13.00	116.17	61.33	1.08	3.08	69.25	11.54	0.00	0.00	11.54	7.69
	H	170.77	167.92	17.69	16.58	128.33	84.67	1.42	2.99	21.62	10.81	0.00	0.00	37.84	29.73
	Mean	149.56	161.16	13.66	13.33	114.65	69.33	1.25	4.41	56.00	9.60	3.20	2.40	13.60	15.20
Kibuyuni	VL	121.58	.	10.58	.	115.25	49.33	1.88	5.51	86.67	4.44	0.00	4.44	4.44	0.00
	ML	138.89	.	15.94	.	118.89	60.38	1.17	4.53	71.41	9.50	0.00	0.00	0.00	19.00
	MH	156.80	.	12.05	.	132.00	62.00	1.00	7.38	90.00	0.00	0.00	5.00	0.00	5.00
	H	169.70	.	12.70	.	133.89	56.00	1.05	4.85	76.20	0.00	0.00	0.00	9.50	14.28
	Mean	145.71	.	12.63	.	124.45	56.39	1.30	5.60	82.60	3.70	0.00	2.70	3.70	5.30
All	VL	119.06	149.97	10.87	12.05	105.39	55.02	1.40	5.62	80.33	3.38	2.70	4.98	4.26	9.24
	ML	140.96	162.46	12.26	12.18	114.06	55.34	1.32	5.27	54.92	16.19	2.82	4.93	7.00	14.10
	MH	158.41	166.45	12.67	13.68	122.17	61.08	1.32	4.82	60.48	9.30	3.10	5.43	5.43	16.28
	H	173.60	169.65	15.55	15.82	130.35	70.32	1.33	4.12	24.64	20.29	8.69	29.00	15.94	27.53
	Mean	147.89	162.13	12.82	13.41	117.92	60.23	1.34	4.60	54.00	12.10	4.60	4.50	8.00	16.80



Table (continued): Characteristics and scores of the surveyed households aggregated at the short term food security group

PARAMETERS												
Groups	Land use				Land assets		Geographic					
	Cultivating (%)	Garden (%)	Field (%)	Individual (%)	Family (%)	D.KMNP (km)	D.Reserve (km)	D.Employer (km)	D.Employer (minutes)	D.Shimoni (km)	D.Shimoni (minutes)	
Mkwiro	VL	0.00	0.00	30.80	15.40	1.50	1.50	4.50	45.00	2.5	30	
	ML	8.30	8.30	50.00	0.00	1.50	1.50	4.50	45.00	2.5	30	
	MH	0.00	0.00	0.00	8.30	1.50	1.50	4.50	45.00	2.5	30	
	H	0.00	0.00	15.40	0.00	1.50	1.50	4.50	45.00	2.5	30	
	Mean	2.00	2.00	24.00	6.00	1.50	1.50	4.50	45.00	2.5	30	
Kibuyuni	VL	91.70	0.00	33.33	11.10	8.50	10.00	8.00	65.00	6	50	
	ML	66.70	0.00	0.00	25.00	8.50	10.00	8.00	65.00	6	50	
	MH	100.00	20.00	16.70	16.70	8.50	10.00	8.00	65.00	6	50	
	H	70.00	0.00	0.00	16.70	8.50	10.00	8.00	65.00	6	50	
	Mean	82.90	4.88	16.00	16.00	8.50	10.00	8.00	65.00	6	50	
All	VL	50.90	24.50	18.00	8.00	7.64	6.61	4.68	40.85	2.94	28.11	
	ML	41.50	26.40	25.00	6.30	6.38	5.70	4.02	35.74	2.73	26.85	
	MH	42.90	20.40	13.30	6.70	6.52	5.99	4.71	41.74	3.14	30.41	
	H	30.30	17.60	17.00	2.10	4.77	4.89	3.24	29.33	2.79	27.60	
	Mean	41.50	22.20	18.30	5.80	6.31	5.78	4.12	36.55	2.89	28.12	



Table: Characteristics and scores of fishing households aggregated at the fisher group level

PARAMETERS															
Scores							Demographic			Land use				Land assets	
Groups	FCSI	FCSI2	STAI	STAI2	LTDI	LTAI	Household Size	Active members	Dependants	Cultivating	Garden	Fields	Individual	Family	
VL	118.38	150.19	10.79	11.71	107.10	56.07	7.14	1.45	5.43	48.30	27.60	24.10	23.10	3.80	
ML	135.00	167.06	11.46	12.50	113.24	55.22	6.17	1.33	5.04	66.70	33.30	33.30	21.70	8.70	
MH	150.44	164.10	11.89	13.00	120.00	61.58	6.72	1.39	5.49	55.60	29.60	25.90	34.80	0.00	
H	166.96	169.08	12.60	13.83	125.92	56.08	4.74	1.18	4.19	56.00	20.00	36.00	5.00	5.00	
Mean	141.99	161.42	11.66	12.64	116.26	57.28	6.26	1.34	5.07	56.20	27.60	29.50	21.70	4.30	

PARAMETERS											
Fishing system						Geographic					
Groups	Not using boats	Using boats	Boat-owners	D.KMNP (km)*	D.Reserve (km)	Median rank of FZ**	FZ 1 (%)	FZ 2 (%)	Z 3 (%)	Z 4 (%)	
VL	42.90	57.10	29.60	7.57	6.48		3	20.70	12.50	40.70	24.00
ML	25.00	75.00	33.33	8.81	7.73		3	27.60	33.30	29.60	52.00
MH	15.00	85.00	55.60	5.93	5.44		2	20.70	8.30	3.70	4.00
H	23.00	76.90	40.00	7.13	7.18		1	31.00	45.83	25.90	20.00
Mean	27.10	72.90	39.80	7.33	6.67		3	24.80	35.20	9.52	30.50

D.: distance

FZ: fishing zone



**Appendix 8: Scores of the fishing households owning and not owning a boat**

**Table : Scores and distances in kilometres aggregated at the fisher group level**

Boat owners						
	Groups	LTAI	LTDI	FCSI2	D.KMNP	D.Reserve
	VL	57.00	107.00	153.29	7.16	5.50
	ML	56.50	106.70	167.70	10.75	7.81
	MH	70.00	124.53	163.27	5.53	5.17
	H	64.00	125.50	168.00	7.65	7.55
	Mean	63.37	118.15	162.77	7.38	6.33
Non Boat owners						
	Groups	LTAI	LTDI	FCSI2	D.KMNP	D.Reserve
	VL	56.10	107.68	145.42	7.38	6.74
	ML	54.53	116.50	166.38	7.84	7.69
	MH	50.09	113.82	165.11	6.42	5.79
	H	50.43	126.21	169.62	6.78	6.93
	Mean	53.24	115.45	159.97	7.17	6.85



## **Appendix 9: Questionnaire (type) for non-local tour operators**

### **1. About history and changes:**

1.1 How long have you been running this operation ?

1.2 What has attracted you to this place?

1.3 Have you noticed any changes in the Shimoni area since you have been here?  
Which changes?

1.4 Have you noticed any changes in the KMNP since you have been here? Which changes?

1.5 Do you consider the management of the KMNP as efficient? In what way?

1.6 What do you consider being the role the KMNP authority?

1.7 What do you consider being the role of the Fisheries Department?

### **2. Economics**

2.1 How many people do you employ?

2.2 Could you indicate the percentage of local (coastal) people you employ in relation to 'non-coastal' people?

2.3 Could you give an indication of how much are your expenses in terms of salaries (monthly)?

2.4 Approximately how many tourists take the day trip (on a yearly basis, or which easier)?

2.5 How much is your park bill on a yearly basis or monthly (high/low season)?

### **3. You and the communities**

Have you ever been involved in any projects/charity in the area? Where? Describe the project.



## **Appendix 10: Semi-structured interview with the KMNP Warden**

The questions were divided into four themes.

### **1. History of the KMNP**

1.1 Why has the park been established where it is?

1.2 Has there been an evolution of the KMNP environment?

### **2. The management of the KMNP**

2.1 How long has KWS managed the KMNP for?

2.2 Has there been management problems or financial problems in the running of the KMNP?

2.3 Is there any poaching going on?

2.4 What are KWS Shimoni human resources?

2.5 What equipment does KWS have?

### **3. The KMNP and the surrounding communities**

3.1 What has the reaction of the communities been to the establishment of the KMNP?

3.2 Have the communities been involved in a way or another in the management of the KMNP?

3.3 How have the relations between the communities and the KMNP authorities evolved?

3.4 Could you describe what you think the benefits and the costs to the communities of the establishment of the KMNP have been.

### **4. Economics**

4.1 How many visitors are there per year/per season on average?

4.2 How much income does KWS Shimoni collect on average per season, per month?

4.3 How much is redistributed to the communities?

4.4 What is the monthly budget allowance to KWS Shimoni?



**QUESTIONNAIRE**

**The results of this questionnaire will be part of a research project currently being carried out on the coast of Kenya, looking at coastal tourism in Kenya.  
We are very grateful for your cooperation.**

Nationality:  
Age:

1. Please, list the main reasons for which you chose to come to Kenya for your holidays.

- 
- 
- 

2. Please, list the main reasons for which you decided to come to Wasini Island.

- 
- 
- 

3. What did you like least during your trip to Wasini? What did you like most?

- 
- 
- 

4. Did you do the village tour?

If you have further comments, please write them on the other side of this sheet.  
When completed, could you please hand in this form to your bus driver.

**THANK YOU VERY MUCH FOR HAVING TAKEN THE TIME TO  
COMPLETE THIS FORM. ENJOY THE REST OF YOUR HOLIDAY!**



**QUESTIONNAIRE**

**Les résultats de ce questionnaire contribueront à un projet de recherche en cours sur le tourisme côtier au Kenya. Je vous remercie d'avance pour votre coopération.**

Nationalité:  
Age:

1. Quelles ont été les raisons principales de votre choix du Kenya comme destination de vacances?

- |   |   |
|---|---|
| • | • |
| • | • |
| • | • |

2. Quelles sont les raisons principales pour lesquelles vous avez choisi de faire cette excursion sur Wasini?

- |   |   |
|---|---|
| • | • |
| • | • |
| • | • |

3. Qu'avez vous le moins apprécié durant cette journée? Le plus apprécié?

- |   |   |
|---|---|
| • | • |
| • | • |
| • | • |

4. Avez-vous fait le tour guidé du village de Wasini?

Si vous avez des commentaires supplémentaires, faites les sur l'envers de cette feuille. Lorsque vous aurez complété ce questionnaire, s'il vous plait remettez le à votre chauffeur de bus.

**MERCI D'AVOIR PRIS LE TEMPS DE REMPLIR CE  
QUESTIONNAIRE. JE VOUS SOUHAITE UNE BONNE CONTINUATION  
DE VOS VACANCES!**